THE THECOSOMATA AND GYMNOSOMATA OF THE SIBOGA-EXPEDITION

Siboga-Expeditie
LII

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BY

J. J. TESCH
Utrecht

With six plates

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INTRODUCTION.

The occurrence of Thecosomata and Gymnosomata, composing together the group of the so-called "Pteropoda", in the seas now explored by the Siboga, has been stated only a few times.

Though QOY and GAIMARD, on the voyage of the Astrolabe, already described several species from Amboina, yet the indications and figures of these zoologists are too fragmentary and incomplete, to throw some more light on the knowledge of these animals.

Afterwards it has been, properly speaking, only the Challenger, which collected specimens from a few places (North of New-Guinea and off the Philippines). Moreover I can mention a Note of v. SCHÉELE (list of literature, MUNTHE 1886). I have also seen some specimens of Thecosomata from the Sunda Straits and Java Sea (Utrecht Zoological Museum).

In a study on the geographical distribution of such essentially pelagic animals as the "Pteropoda" are, I have preferred to take a larger field of exploration than the area in which the Siboga-material was collected.

For that reason I have accepted the Australasian province, proposed by PELSENEER [1]) (almost agreeing with the Indian province of KEFERSTEIN [2]), viz. the East-Indian Archipelago, the China Sea, the Philippines and the seas of North-Australia.

1) Challenger Report. LVIII, p. 62.
2) In BRONN's Thierreich. Bd. III, p. 1135.

In this pelagic province 26 species of Thecosomata have been found until now, which are all mentioned in this Report; 23 of these species are represented in the collection, brought home by the Siboga; 4 of them are new.

Of the 10 species of Gymnosomata, now recorded from the province in question, only 2 were not found again. Besides, 5 species out of the 8 had not been described yet. One species belongs to a new genus. So, from a systematic point of view, we may say that these results are satisfactory.

Notwithstanding the anatomy of the two groups has already been studied by rather a great number of previous authors, yet I thought it not superfluous to make another inquiry into the anatomy, to which I could perhaps contribute something and add a few corrections of former statements. For anatomical purposes I made use of the material of the Siboga-Expedition, of the Leyden Museum, of the Zoological Museum of Amsterdam and of the Utrecht Museum.

It has never been my intention to give an anatomical monograph, nor even a complete comparative study, as has already been so excellently done by PELSENEER [1]). For such a purpose, the material at my disposal has been insufficient. After the discussion of every genus, I have given some anatomical notes, in which I confined myself chiefly to those facts, which were new or contrary to previous assertions.

Though I am aware of many lacunae in my study on the anatomy, they are very often not my fault, but due to want of material. For the rest, I greatly hope to complete these researches and to add histological and embryological facts at the Naples Zoological Station.

Lastly I have to thank my esteemed teacher, prof. HUBRECHT, who, during my study at the Utrecht Laboratory, assisted me with his great experience, also Dr. H. F. NIERSTRASZ, who supplied me with material from Naples, and finally Dr. R. HORST, by whom the material of the Leyden Museum was sent to me. Since my stay in London I keep in grateful remembrance the names of Prof. F. J. BELL and mr. EDG. A. SMITH, through whose kindness I have had occasion to study the material of the Challenger, and the valuable collection of thecosomatous shells in the British Museum.

1) Challenger Report. LXVI.

CLASSIFICATION OF THE "PTEROPODA".

In the phylum Mollusca there are still always some groups, the systematic place of which has usually been misunderstood. Partly this must be attributed to the still very incomplete knowledge we possess about their anatomy and embryology, so that many and serious investigations are still necessary to throw some light on affinities, difficultly to be discovered — partly, however, also to conservative ideas, a habit to keep old divisions and notions — I should nearly say: though the zoologists themselves knew better.

But this being the case, the more it is every investigator's duty, who has had the opportunity to study such a "doubtful" group, to point out wherever he can, the phylogenetic affinity of the group to others. For this relation, though it has been proved long ago, has not yet generally been accepted. So it will perhaps not be bad to give once more a short survey of the different opinions, which have prevailed and prevail still with respect to the systematic position.

We need not stop long at the opinions of the first investigators, who wished to classify the Pteropoda with other groups. So in 1756 BROWNE [1]) classified some animals which he described as *Clio* among the Zoophytes; while FORSKÅL [2]) thought that his "*Anomia tridentata*" belonged to the group of the Acephala.

LAMARCK [3]) was of the same opinion afterwards; he too brought *Clio* and *Pneumonoderma* to this class, and thought that they formed a transition of the Acephala to the Gastropoda. On the expedition of LAPEYROUSE LAMARTINIÈRE [4]) found an animal which he recognised as having been described by BROWNE, and classified it among the Insects. In those years the lower animals were all grouped with the Insecta or the Vermes. PALLAS [5]), who examined "*Clione borealis*", found some resemblance with the genus *Sepia* of LINNÉ.

With CUVIER's examination of "*Clio borealis*", the systematic place of this animal became somewhat more distinct. CUVIER [6]) denied the affinity with his Cephalopoda and found the

1) The civil and natural history of Jamaica. p. 386.
2) Faune arabique. p. 124, 1773.
3) Philosophie Zoölogique. Vol. I, p. 319.
4) Journal de physique. Septembre 1787.
5) Spicilegia zoologica. Fasc. X, p. 28, tab. I, fig. N° 19, 1774.
6) Mémoire sur le Clio borealis. Ann. Mus. d'Hist. Nat. Paris 1802, Vol. II, p. 249.

resemblance with Gastropoda greater and in consequence did not think it necessary to bring *Clio* to a separate order. Yet, this was done by him two years afterwards [1]). And on *his* great authority only, later investigators accepted his division.

The "ordre des Ptéropodes" remained, and the only modification, made by CUVIER himself afterwards [2]), was that the "orders" of CUVIER were now called "classes". That the notion of "class, order" etc. was not yet fully comprehended, is illustrated by the following fact: in 1810 PÉRON and LESUEUR, who have the same opinion as CUVIER with respect to the systematic treatment, speak of the "famille des Ptéropodes" in their article: Histoire de la famille des Mollusques Ptéropodes. Ann. Mus. d'Hist. Nat. Paris 1810. Vol. XV, p. 71.

That the Pteropoda constitute a separate class among the Mollusca has long been a prevalent opinion and is perhaps so still. It would be going too far, to mention the names of all those who have stuck to this opinion.

Of the zoologists of later time, some of whom have at least made studies of their own about the organisation of the Pteropoda, the best known are:

LOVÉN (1848), TROSCHEL (1848), OWEN (1855), BURMEISTER (1856), WOODWARD (1856), KEFERSTEIN (1866), SCHMARDA (1872), VON IHERING (1876), HUXLEY (1877), GEGENBAUR (1878), CLAUS (1882).

In this respect we must not overlook the fact that GEGENBAUR [3]) brought Gastropoda, Pteropoda and Heteropoda all to one class, viz. the Cephalophora ("Gastropoda im weiteren Sinne"), maintained this opinion in his "Vergleichende Anatomie", and then changed his mind so much afterwards. On the other hand, CLAUS regards the Pteropoda as an order of the Gastropoda in his third edition of his "Lehrbuch der Zoologie" p. 574 (1885). And VON IHERING, who in 1876 [4]) emphatically pointed to the conformity of the two classes: Pteropoda and Cephalopoda has changed his opinion afterwards [5]), at least with respect to the pretended resemblance.

The general conviction is that the Pteropoda are nearest related to the Cephalopoda. This opinion, maintained by many zoologists so persistently, was principally founded on the resemblance of the head-appendages of the Gymnosomata and the arms of the Cephalopods.

Some have even gone so far that they regarded the Pteropoda as an order of the Cephalopoda. This idea, first pronounced by OKEN [6]), was held afterwards by RAY LANKESTER [7]), who divided the class Cephalopoda in two groups:

a. Pteropoda and *b.* Siphonopoda (= Cephalopoda s. str.).

It was in 1821 that DE BLAINVILLE pointed out the many points of resemblance which the Pteropoda had with the Gastropoda [8]). It was his opinion that the Bulloidea were the

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1) Sur l'Hyale. Sur un nouveau genre de Mollusques nus (le Pneumodermon) et sur l'établissement d'un nouvel ordre de Mollusques (les Ptéropodes). Ann. Mus. d'Hist. Nat. Paris, Vol. IV, p. 232.

2) Règne animal. Paris 1817, Vol. II, p. 378.

3) GEGENBAUR. Untersuchungen über Pteropoden und Heteropoden. Leipzig 1855, p. 189.

4) Vergl. Anatomie des Nervensystems und Phylogenie der Mollusken. 1876, p. 272.

5) Zeitschr. Wissenschaftl. Zool. 1881, Bd. 35, p. 4. Über die Verwandschaftsbeziehungen der Cephalopoden.

6) Lehrbuch der Zoologie. Bd. I, p. 326.

7) Encyclopaedia Britannica. 9th Ed. Vol. XVI, 1883.

8) Dict. des sciences naturelles. Prt. XXII, p. 66.

nearest relations of the Pteropoda. Some years afterwards, he applied this opinion to his classification of the Mollusca [1]). This view of the matter, combated by DE FÉRUSSAC [2]) and D'ORBIGNY [3]) with many words and apodictic sentences, but not with arguments, found however defenders.

First it was DESHAYES [4]), who for the rest did not give observations of his own nor procured new proofs — but it was SOULEYET especially, who with extraordinary ability defended his opinion [5]) and, after a long series of researches of his own, adhered to DE BLAINVILLE's opinion.

CLARKE in England (1851) had classified the Pteropoda among the Opisthobranchia, but had not made researches himself, as far as I know at least, while LEUCKART (1848) also mentions the Pteropoda, as being an order among the Gastropoda.

But in the many years that followed this period, there was scarcely a zoologist who pronounced an opinion about DE BLAINVILLE's views. The "class" of the Pteropoda remained and it was not until a thirty years after, in 1880, that SPENGEL [6]) reckoned the Pteropoda among the Gastropoda Euthyneura and, a short time after, GROBBEN [7]) expressed his opinion that the Pteropoda were an order of the Gastropoda, while he considers *Gasteropteron* as very nearly related to the Pteropoda at any rate.

Soon after, within a short time, two works appeared, which after that of SOULEYET, being founded on extensive researches of their authors, have attributed most of all to the opinion that the Pteropoda belong to the Gastropoda.

BOAS's study [8]), which appeared in 1886, chiefly treated of the systematic position. But his numerous arguments and the causal connection, pointed out by him, between the gradually changing organisation and the pelagic way of living of the Pteropoda, made the correctness of DE BLAINVILLE's opinion indisputable.

Just as DE BLAINVILLE had done already, BOAS too regarded the Bulloidea as the nearest relations of the Thecosomata [9]). But he did not express an opinion on the question, from which group of the Tectibranchia the Gymnosomata descended [10]). Here the following question presents itself for the first time: whether the Thecosomata and Gymnosomata really possess that near affinity which can justify their union to one group, the "Pteropoda".

BOAS was the first who indicated the great difference between these two sub-groups. And in saying that the fins were not homologous, he proposed that henceforth [11]) the Thecosomata should be called Eupteropoda and the Gymnosomata Pterota.

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1) Manuel de Malacologie et de Conchyliologie. 1825. The Pteropoda are regarded as an order, the Aporobranchia, and divided into Thecosomata and Gymnosomata. The genus *Limacina*, called by him *Spiratella*, was classified by him as belonging to the Heteropoda.

2) Hist. nat. générale et particulière des Mollusques. p. 37.

3) Voyage dans l'Amérique méridionale. Vol. V, p. 65.

4) Encyclopédie Méthodique. Hist. Nat. des Vers. Paris 1830, Vol. II, p. 552.

5) Voyage de la Bonite. Paris 1852, Vol. II, p. 88—89.

6) Geruchsorgane und Nervensystem der Mollusken. Zeitschr. Wissenschaftliche Zoologie. Bd. XL, p. 373. Also see p. 366 and p. 381, note 1.

7) Morphologische Studien über den Harn- und Geschlechtsapparat, sowie die Leibeshöhle der Cephalopoden. Arb. Zool. Inst. Wien 1884, Bd. V, p. 61—67.

8) BOAS. Spolia Atlantica. Bidrag til Pteropodernes Morfologi og Systematik samt til Kundskaben om deres geografiske Udredelse. Vidensk. Selsk. Skr. 6. Raekke. Bd. IV, 1.

9) Op. cit. p. 36.

10) Op. cit. p. 149.

11) Op. cit. p. 13 and 14.

Still more than BOAS, it is PELSENEER who has largely contributed to the knowledge of these Mollusca. In 1885 he expressed his opinion [1]) that the Pteropoda were related to the Euthyneura and this conviction was kept by him in the years following [2]). In the Challenger Reports we find his most extensive paper, written on this subject [3]). In this work, after treating in details the confused nomenclature and establishing the precisely different types (something which can only be mentioned here in a few lines), he discussed briefly and distinctly the different opinions with respect to the systematic place of the Pteropoda.

It would be going too far to expatiate long, on what PELSENEER has explained in his work with an abundance of proofs, taken from anatomy. Some of the results of his study, though somewhat abridged, follow here [4]).

A. The Pteropoda do not constitute among the Mollusca a class of the same value as the Cephalopoda, Gastropoda, etc.

B. The Pteropoda are not primitive Mollusca, but are a derived and recent group.

C. They have no affinity with the Cephalopoda.

D. They are Gastropoda, in which the adaptation to pelagic life has so modified their external character, as to give them an apparent symmetry.

E. Among the Gastropoda they do not constitute a distinct class, not even an order.

F. They belong to the Euthyneura and among these to the Tectibranchiate Opisthobranchs.

G. The Pteropoda are polyphyletic in their origin; the Thecosomata and Gymnosomata are two independent groups.

H. The Thecosomata have descended from the Bulloidea.

I. The Gymnosomata have descended from the Aplysioidea.

From these results we learn that the group of the Pteropoda, according to PELSENEER, is an unnatural union of Thecosomata and Gymnosomata, two sections which must be classified separately to the Tectibranchia, and so the Thecosomata to the Bulloidea (Cephalaspidea) and the Gymnosomata to the Aplysioidea (Anaspidea).

In this short survey on the subject, there can be no question of going into details with respect to PELSENEER's arguments, and it is sufficient to draw the attention to the fact that the Pteropoda are of polyphyletic origin. PELSENEER denies, that the fins of the Thecosomata and Gymnosomata should not be homologous; according to him the fins of both the groups are parapodia.

In the fifteen years that have passed since PELSENEER's work appeared, his opinion and that of BOAS on the Gastropoda-nature of the Pteropoda, has gradually found more adherents. Though few researches have been made since 1888 and only some articles on a single specimen or a single organ have been written, yet different zoologists have become convinced of the correctness of PELSENEER's assertion.

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1) The cephalic appendages of the Gymnosomatous Pteropoda and especially of Clione. Quarterly journal Micr. Sc. (2) Vol. 25, p. 506.

2) Recherches sur le système nerveux des Ptéropodes. Arch. de Biol. T. VII, p. 127. Description d'un nouveau genre de Ptéropode Gymnosome. Bull. sc. Dép. du Nord. p. 226.

3) Zool. Chall. Rep. LVIII, Gymnosomata, 1887. LXV, 1888 (Thecosomata). Prt. LXVI (Anatomy of Pteropoda).

4) Challenger Report. LXVI, p. 95, 96.

Among them I can mention SIMROTH [1]), CROSSE [2]), GROBBEN [3]), KORSCHELT [4]), and VON IHERING [5]). In most manuals and text-books on zoology, the Pteropoda are mentioned either as an order of the Gastropoda, or as a sub-order of the Opisthobranchia [6]). Yet the pretended relationship of the Pteropoda with the Cephalopoda has given occasion to SCHALFEJEFF [7]) to draw the attention to the homology of the head-appendages of *Clione* with the arms of the Decapoda. SMITH [8]), though referring to PELSENEER, calls the Pteropoda a separate class (a mistake also made by VOGT and YUNG some years before [9]); while the title of VILLOT's work [10]) with respect to the classification of the Mollusca, does not seem justified in any respect, and his systematization is anything but "actuel".

That the Pteropoda descend from the Tectibranchia is no more a knotty point, but a question on which most investigators have agreed.

On the polyphyletic origin of the Thecosomata and Gymnosomata and for that reason their not admitting of the name "Pteropoda", only few have expressed an opinion.

Though the foundation of BOAS's opinion was said to be wrong, according to PELSENEER, yet the latter has adduced sufficient proofs, which justify his opinion on the different origin of both groups of Pteropoda. Later on, SIMROTH has acknowledged that the conformity between Thecosomata and Gymnosomata was only apparent and is founded on convergency.

MAZZARELLI [11]), who examined the Aplysioidea, says that they are connected by the Notarchidae with the Pteropoda [12]), which is also mentioned by PELSENEER, who spoke about a Notarchus-form as being the precursor of the Gymnosomata, KORSCHELT [13]), however, thinks that embryology speaks in favour of a very near affinity between the two groups and that the Gymnosomata are phylogenetically younger than the Thecosomata and descend from these, an assertion, formerly pronounced by WAGNER [14]). As to myself, I have been able to study rather extensively the anatomy of the Thecosomata as well as of the Gymnosomata. And because nearly always — and with respect to the main points continually — I found PELSENEER's researches affirmed by mine, I cannot but agree with him. And, referring to the results mentioned above, I can only confirm his assertions. For that reason I think it better, not to use the name Pteropoda any longer, as it combines two groups, which in fact have no more connection with each other, as is expressed by the characters of Bulloidea and Aplysioidea.

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1) Ueber einige Tagesfragen der Malacozoologie, hauptsächlich Convergenz-Erscheinungen betreffend. Zeitschr. Naturw. Halle 1889, Bd. 62, p. 65—97.

2) A new classification of the Mollusca by W. H. DALL. Journ. Conchyl. 1884. Paris 1889, Tome 29, p. 82, 83.

3) Zur Morphologie des Pteropodenkörpers. Arb. Zoöl. Inst. Wien 1889, 8er Bd., p. 155—157.

4) Lehrbuch d. Vergl. Entw. Gesch. der Wirbell. Thiere. Spec. Theil. Jena 1893. (Molluscs by KORSCHELT).

5) Sur les relations naturelles des Cochlides et des Ichnopodes. Bull. Sc. France. Tome 23, p. 148—257.

6) R. HERTWIG (1894), The Cambridge Natural History (Molluscs by COOKE) 1895, PARKER and HASWELL (Textbook of Zoology, 1897), GOETTE (1902). Also in the Zool. Record since 1892, and in LANG's Lehrbuch der Vergl. Anatomie der Wirbellosen Thiere.

7) Zur Anatomie der Clione Limacina Phipps. Zool. Anz. 12 Jahrgang. p. 188—190.

8) Report on the Marine Molluscan Fauna of the Islands of St. Helena. P. Z. S. 1890. Pteropoda. p. 254.

9) Lehrb. d. Pract. Vergl. Anatomie. Bd. I. Pteropoda. p. 828—852.

10) La classification zoölogique dans l'état actuel de la science. Revue Biol. Lille 1891, 3ième année, p. 245—261.

11) Monografia delle Aplysiidae del golfo di Napoli. Mém. Soc. Ital. Sc. dei XL (3). Tomo 9, N0 4, 1893.

12) To my opinion it would have been better to say: Gymnosomata.

13) Op. cit. p. 1046.

14) Die Wirbellosen des Weissen Meeres. Bd. I, p. 119, 1885.

THECOSOMATA de Blainville

1821. *Thecosomata* de Blainville, Dict. des Sc. Nat., t. XXXII, p. 271.
1885. *Pterocephala* (*part.*) Wagner, Die Wirbellosen des Weissen Meeres, Bd. I, p. 119.
1886. *Eupteropoda* Boas, Spolia Atlantica, p. 14.

The great number of genera, in which the species of the Thecosomata were divided, has been reduced to eight by PELSENEER [1]). These genera belong to three families, which, especially with respect to the shape of the shell, differ sufficiently from each other, to be distinguished at first sight. They are Limacinidae, Cavoliniidae and Cymbuliidae.

The external parts of the body of the Thecosomata: the shape of the foot, of the fins, of the tentacles, etc., have been described so often and in details, that it does not seem necessary to repeat what has been said on this subject by SOULEYET [2]), BOAS [3]) and PELSENEER [4]) — neither have the general anatomical characters need to be spoken of.

What has been published about the anatomy by VAN BENEDEN [5]), GEGENBAUR [6]), SOULEYET [2]), BOAS [3]) and others, was still importantly augmented by PELSENEER by an exact anatomical study of each genus separately [7]). PELSENEER gives thirty-four generic names. To my opinion two other names ought to have been mentioned among these: *Anomia* Forskål and *Gioenia* Gioëni (both = *Cavolinia* ABILDGAARD). This last genus I can only mention on the authority of DE BLAINVILLE (article Hyale in Dict. d. Sc. Nat. XXII) and of SOULEYET (Hist. Nat. Ptérop. p. 33, note 1), as I have not had the opportunity to see GIOËNI's work myself. The species of the genus *Agadina* have been recognised by PELSENEER himself as Gastropoda-larvae (Streptoneural).

Through these investigations it has been sufficiently proved:

1° that the Thecosomata descend from the Bulloidea,
2° that the Limacinidae are the original forms,
3° that further specialisation with the intention of accommodating to the pelagic way of living, has led to the apparent (external) symmetry, which appears in most forms of the Cavoliniidae and
4° that these two families do not descend from each other, but that the external and internal characters of the genus *Peraclis* among the Limacinidae are connected to each other on the one side by *Limacina* with the Cavoliniidae, on the other by larval stages of *Cymbulia* with the Cymbuliidae.

The question in how far there is any connection between the dorsal mantle hole of the Limacinidae and the ventral one of the Cavoliniidae — which is accompanied by a great many other differences between the two families — has been spoken of by SOULEYET and GROBBEN.

1) Challenger Report. LXV, p. 5—8.
2) Voyage de la Bonite. Vol. II, 1852.
3) Spolia Atlantica. 1885.
4) Challenger Report. LXV, LXVI, 1888.
5) Exercices Zoötomiques. Mém. Acad. Sc. Brux. 1841, Vol. XII, 1839. Mém. sur la Limacina arctica. Op. cit. Vol. XIV.
6) Untersuchungen über Pteropoden und Heteropoden. Leipzig 1885.
7) Challenger Report. LXVI, p. 5—37.

SOULEYET [1]) regards the representatives of his genus *Spirialis* as being simply *Cleodora*-forms "dont la partie postérieure du corps et de la coquille sont contournées en spirale", while GROBBEN [2]), who thinks that the ventral mantle-hole is the original one, attributes the dorsal position to the twisting of the visceral mass, but calls the mantle-hole of the Cavolinidae secondary-ventral.

BOAS [3]) was the first who gave an explanation of the connection, mentioned above.

He pointed out, how the Cavolinidae have proceeded from the Limacinidae by a turn of 180° (in the opposite direction of the hands of a clock) of the hind part of the body, which has stretched itself with respect to the head part, so that the latter (foot, fins, tentacles, penis, etc. [4]) shows the greatest conformity in both the families. But the mantle-hole, the ending of the intestinal canal, the heart, the efferent duct of the gonad, are differently situated in both families in so far that the organs which are situated dorsally, ventrally, to the right, or to the left in the Limacinidae, have their place just in the opposite direction in the Cavolinidae.

BOAS fully explained his assertion, so that I can refer to his work for further particulars. PELSENEER [5]) modified BOAS' theory somewhat. According to him, it is not the hind part that has made a turn of 180° with respect to the fore part (or *vice versa*), but both the parts have turned 90° in different directions with respect to each other. This had to be proved by the retractor muscle. According to BOAS [6]), part of this muscle, running to the right of the oesophagus, is a new formation, while PELSENEER, referring to FOL [7]), just regards this branch as being the original, which also radiates in both the fins.

At the same time PELSENEER showed the affinity between the Limacinidae and the Cymbuliidae, which had not been discovered by any investigator before him. Here, too, the revolving process of 180° has taken place. Though the full-grown animals of the Cymbuliidae seem to show very little resemblance with the Limacinidae, yet there are a great many important points of conformity with *Peraclis* in respect to the (left-handed) larvae of the first mentioned family.

Family I. LIMACINIDAE.

1847. *Limacinidae* Gray, the Genera of recent Mollusca, Proc. Zool. Soc. London, p. 203.
1853. *Hyalidae (part.)* d'Orbigny, in Ramon de la Sagra, Histoire physique, politique et naturelle de l'île de Cuba, vol. I, p. 70.
1859. *Spiralidae* Chenu, Manual de Conchyliologie, vol. I, p. 113.
1863. *Limacinacea* Troschel, Das Gebiss der Schnecken, Bd. I, p. 50.

The animals, representing this family, are nearly always very small. A dimension of a few mm. may be called considerable already, and there are only two species which strike the

1) SOULEYET. Voyage de la Bonite. Vol. II, p. 208—215.
2) Harn- und Geschlechtsorgane der Cephalopoden. Arb. Zool. Inst. Wien. Tome 5, p. 63.
3) Spolia Atlantica. p. 19—22.
4) But not the central nervous system, as BOAS says.
5) Challenger Report. LXVI, p. 28—37.
6) Spolia Atlantica. p. 22, note 1.
7) Arch. de Zoologie. exp. 1875, Vol. IV. Sur le développement des Ptéropodes. pl. IV, fig. 43, 44.

eye by a somewhat larger size. To the smallness of the animals it must be attributed that before BOAS and PELSENEER only a few attempts have been made, to bring some order in the confusion, which also reigned here.

SOULEYET [1]) distinguished two genera: *Limacina* without operculum, and *Spirialis* with operculum. Since, however, an operculum has been found [2]) in *Limacina helicina*, the only representative of the genus *Limacina*, as SOULEYET understood it, now the difference between the two genera cannot exist any longer. BOAS [3]) brought all the species of the family together to the single genus *Limacina*, but PELSENEER's researches [4]) have proved that there are two very distinct genera: *Limacina* and *Peraclis*.

The study of the collection, brought home by the Challenger, has given occasion to PELSENEER to distinguish [5]) ten species. Two of them, however, must be considered rather doubtful, as the animals have never been found as yet, and only the empty shells were brought up from the bottom of the sea (*Limacina triacantha* and *Limacina helicoides*). So we cannot state with certainty, whether we have to do with "Pteropoda".

As the Siboga Expedition has only caught three species of *Limacina*, and as of the other species I could only study *Limacina helicina*, I have not been able to observe the specific differences, given by PELSENEER. The three species of the Siboga-material, however, are clearly distinct from each other.

Of the genus *Peraclis* two species have been known up to now, though of *Peraclis bispinosa* [6]) only the empty shells have been found. The Siboga Expedition has added two new species, and a variety of an already known one.

With a few words I must draw the attention to the well-known fact, that the shell of the Limacinidae is left-coiled, while the animals themselves possess the organisation of right-handed Gastropoda. The shell is in this case ultra-dextral which, as one knows, also occurs in some species of the genus *Ampullaria*. The spira of a right-coiled shell may become more and more flattened, then the shell may be rolled up in one plane, and finally it appears in the place where originally the umbilicus has been, which now takes the place of the spira. The operculum does not take any part in this process, consequently it retains the direction of its coils.

According to SOULEYET [7]), the operculum of the Limacinidae is right-handed, except in one case, where it is figured *in situ* in *Limacina bulimoides* [8]).

In SARS's paper [9]) too, the operculum of *Limacina helicina*, "*Spirialis*" *balea* and

1) Hist. nat. d. Moll. Ptérop. p. 60—65.
2) SARS, Mollusca regionis arcticae Norvegiae, Christiania, 1878, p. 328, pl. 29, fig. 1*e*.
3) Spolia atlantica, p. 39.
4) Chall. Rep. LXV, p. 9—15.
5) Ibid., p. 17—37.
6) Ibid., p. 36.
7) Voyage de la Bonite, Mollusques, pl. XIII.
8) Op cit. pl. XIII, fig. 36.
9) Mollusca regionis arcticae Norvegiae, pl. 29, figs. 1*e*, 2*d*, 3*a*.

"*Spirialis*" *retroversus* is coiled to the right, while BOAS figured [1]) that of "*Limacina*" *reticulata* as a right-handed spiral. PELSENEER corrected [2]) this, but he says about the operculum of *Limacina* that it exhibits a right-coiled direction [3]).

In reality the operculum of *Peraclis* is left-coiled, as it has been represented by D'ORBIGNY, long before SOULEYET.

PELSENEER stated [4]) afterwards that the operculum of *Limacina retroversa* was left-handed, a fact which, after my own researches, holds good in the three species of the Siboga-material too. The operculum of *Limacina inflata* is figured Pl. I, fig. 1. In the two other species it shows a more elongated shape.

In *Peraclis* the operculum exhibits the same left-handed direction.

The beginning of its spiral is turned to the umbilicus (false spira).

Limacina Cuvier.

1817. *Limacina* Cuvier, Le Règne animal, t. II, p. 380.
1823. *Heterofusus* Fleming, On a reversed species of *Fusus*, Mém. Wern. Soc., p. 498.
1824. *Spiratella* de Blainville, Dict. d. Sci. Nat., t. XXXII, p. 284.
1836. *Heliconoides (part.)* d'Orbigny, Voyage d. l'Amér. mér., t. V, p. 174.
1840. *Spirialis (part.)* Eydoux et Souleyet, in: Revue Zoöl., t. III, p. 235.
1842. *Helicophora* Gray, Synopsis of the contents of the British Museum, p. 59.
1844. *Scaea* Philippi, Fauna Molluscorum utriusque Siciliae, p. 164.
1861. *Protomedea (part.)* Costa, Microdoride mediterranea, p. 73.
1869. *Embolus* Jeffreys, British conchology, vol. V, p. 114.
1885. *Limacina (part.)* Boas, Spolia atlantica, p. 39.

1. *Limacina inflata* (d'Orbigny).

1836. *Atlanta inflata* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 174, pl. 12, figs. 16—19.
1840. *Spirialis rostralis* Eydoux et Souleyet, Description sommaire de plusieurs Ptéropodes nouveaux ou imparfaitement connus, Revue Zoölogique, vol. 3, p. 236.
1850. *Limacina inflata* Gray, Catalogue of the Mollusca in the collection of the British Mus., Prt. II, Pteropoda p. 31.
1852. *Limacina scaphoidea* Gould, The Mollusca and Shells of the U. S. Exploring Expedition, p. 485, pl. 51, fig. 602.
1861. *Protomedea elata* O. G. Costa, Microdoride mediterranea, p. 74, pl. 11. fig. 5.
1870. *Embolus rostralis* Jeffreys, Mediterranean Mollusca, Ann. and Mag. Nat. Hist., ser. 4, vol. 6, p. 86.
1882. *Protomedea rostralis* Fischer, Sur le faune Malacologique abyssale de la méditerranée, Comptes rendus, vol. XCIV, p. 120.
1889. *Embolus inflatus* Dall, in: Bullet. U. S. Nat. Mus., n^0 37, p. 80.

Living animals:

Stat.	35. 8° 0'.3 S., 116° 59' E.	1 spec.
Stat.	66. Between Bahuluwang a. Tambolungan, south of Saleyer.	2 spec.
Stat.	95. 5° 43'.5 N., 119° 40' E. Sulu Archipelago.	2 spec.

1) Spolia atlantica, pl. III, fig. 39*bis*.
2) Chall. Rep. LXV, p. 33.
3) Ibid., p. 16.
4) Sur la dextrorsité de certains Gastropodes dits "sénestres". Comptes rendus, 1891, t. CXII, p. 1016.

Stat. 116. 0° 58′.5 N., 122° 42′.5 E. West of Kwandang Bay, entrance.	1 spec.
Stat. 138. East coast of Kajoa Island.	1 spec.
Stat. 141. 1° 0′.4 S., 127° 25′.3 E. Batjan.	20 spec.
Stat. 143. 1° 4′.5 S., 127° 52′.6 E.	1 spec.
Stat. 144. North of Damar Island.	1 spec.
Stat. 146. 0° 36′ S., 128° 32′.7 E. $2^1/_2$ miles north of eastern Widi Group.	1 spec.
Stat. 148. 0° 17′.6 S., 129° 14′.5 E.	23 spec.
Stat. 177a. 2° 30′ S., 129° 28′ E.	2 spec.
Stat. 185. 3° 20′ S., 127° 22′.9 E. Manipa Strait.	1 spec.
Stat. 189a. 2° 22′ S., 126° 46′ E.	5 spec.
Stat. 194. 1° 53′.5 S., 126° 39′ E.	1 spec.
Stat. 203. 3° 32′.5 S., 124° 15′.5 E.	1 spec.
Stat. 210a. 5° 26′ S., 121° 18′ E.	1 spec.
Stat. 243. 4° 30′.2 S., 129° 25′ E.	20 spec.
Stat. 245. 4° 16′.5 S., 130° 15′.8 E.	2 spec.

This species seems to live in the whole East-Indian Archipelago, which was explored by the Siboga. On some stations it was very abundant.

Some specimens exhibit a brown spot on the last whorl of the shell, just above the aperture. Besides, the animals differ a little in size.

I have not found the "lame vitrée", mentioned by SOULEYET [1]).

The animal has no dorsal lobe on the fin.

*2 [2]). *Limacina lesueurii* (d'Orbigny).

1836. *Atlanta lesueurii* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 177. pl. XX, figs. 12—15.
1836. *Atlanta rangii* d'Orbigny, Ibid., p. 176, pl. XII, figs. 25—28-
1840. *Spirialis ventricosa* Eydoux et Souleyet, Description sommaire de plusieurs Ptéropodes nouveaux on imparfaitement connus, Revue Zoölogique, vol. III, p. 236.
1850. *Limacina ventricosa* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 32.
1886. *Limacina lesueurii* Boas, Spolia atlantica, p. 46. Pl. III, figs. 33—34.
1887. *Limacina rangii* Munthe, Pteropoder i Upsala Universitets Zoologiska Museum, Bihang till K. svenska vet.-akad. Handlingar, Band 13, Afd. IV, n° 2, p. 8, figs. 12—13.

Limacina lesueurii has been found off Batavia (BOAS) [3]) and again by the Challenger Expedition 2° 56′ N., 134° 11′ E. (north of New Guinea). However, the Siboga did not succeed in finding it again.

As I had no occasion to study any specimen I cannot say whether D'ORBIGNY is right, who erected a new species for his *Atlanta rotunda* [4]). The figures of the shell indeed seem to refer to *Limacina lesueurii*, and perhaps it is only a variety of the type, as SOULEYET [5]) regarded it. But D'ORBIGNY says in the text, that the shell of *Atlanta rotunda* is "à peine ombiliquée", and the margins are "épais"; the operculum "circulaire, formé de lignes

1) Voyage de la Bonite, vol. II, p. 216. Pl. XIII, fig. 7—8.
2) The species, not obtained by the Siboga are marked by an asterisk.
3) Spolia atlantica, p. 47.
4) Voyage dans l'Amérique méridionale, vol. V, p. 175, pl. XII, figs. 20—24.
5) Voyage de la Bonite, vol. II, p. 219.

concentriques vers le centre". If this proves to be true, we must entertain some doubts whether *Atlanta rotunda* is even a "Pteropod". MUNTHE has regarded it as a distinct species (see the list above of synonyms) but it was referred by PELSENEER [1]) to the genus "*Agadina*".

As to *Atlanta rangii*, it differs so very slightly from *Limacina lesueurii*, that it cannot be regarded as a distinct species, as MUNTHE (see above) [2]) has done. The umbilicus is only somewhat wider, quite as in *Spirialis ventricosa*.

3. *Limacina trochiformis* (d'Orbigny).

1836. *Atlanta trochiformis* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 177, pl. XII, figs. 29—31.
1840. *Spirialis trochiformis* Eydoux et Souleyet, Description sommaire de quelques Ptéropodes nouveaux ou imparfaitement connus, Revue Zoölogique, vol. III, p. 237.
1850. *Limacina trochiformis* Gray, Catalogue of the Mollusca in the collection of the British Museum, Prt. II, Pteropoda, p. 33.
1852. *Limacina naticoides* Rang, Histoire naturelle des Mollusques Ptéropodes, pl. X, figs. 1—2.

Living animals:

Stat. 59.	10° 22'.7 S.,	123° 16'.5 E. Western entrance Samau Strait.	2 spec.
Stat. 121.	1° 33'.7 N.,	124° 46'.5 E. Menado.	1 spec.
Stat. 138.	0° 23'.8 N.,	127° 29' E. East-coast of Kajoa Island.	1 spec.
Stat. 148.	0° 17'.6 S.,	129° 14'.5 E.	1 spec.
Stat. 203.	3° 32'.5 S.,	124° 15'.5 E.	1 spec.
Stat. 214.	6° 30' S.,	121° 55' E.	2 spec.

Nothing can be remarked about the geographical distribution of this species. It seems rarer than *Limacina inflata*.

No tentacular lobe on the dorsal margin of the fin.

4. *Limacina bulimoides* (d'Orbigny).

1836. *Atlanta bulimoides* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 179, pl. XII, figs. 36—38.
1840. *Spirialis bulimoides* Eydoux et Souleyet, Description sommaire de quelques Ptéropodes nouveaux ou imparfaitement connus, Revue Zoölogique, vol. III, p. 238.
1850. *Limacina bulimoides* Gray, Catalogue of the Mollusca in the collection of the British Museum, Prt. II, Pteropoda, p. 34.
1889. *Limacina (Heterofusus) bulimoides* Dall, in: Bullet. U. S. Nat. Mus., n° 37, p. 80.

Living animals:

Stat. 138.	0° 23'.8 N.,	127° 29' E. East coast of Kajoa Island.	1 spec.
Stat. 143.	1° 4'.5 S.,	127° 52'.6 E.	1 spec.
Stat. 148.	0° 17'.6 S.,	129° 14'.5 E.	10 spec.
Stat. 243.	4° 30'.2 S.,	129° 25' E.	2 spec.

Like the foregoing species.

Some slight difference in size among the individuals may be noticed.

No tentacle-like lobe on the anterior fin margin.

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1) Challenger Report LXV, p. 40.

2) It may be remarked, that the figure of MUNTHE shows the margins of the shell thickened, while D'ORBIGNY says: "bords tranchants".

Anatomical Remarks.

Our knowledge about the anatomy of the genus *Limacina* being considerably enriched by PELSENEER's researches [1]), I have scarcely anything to add to what has been published by this able investigator. As he has done, so have I studied *Limacina helicina* (from Matotschkin Strait). The shell, the fins of the animal, its radula and jaws have been figured by SARS [2]) (radula also by BOAS) [3]), the tentacles and the whole visceral anatomy have accurately been described by PELSENEER, to whose figures I can moreover refer [4]).

The chief point is the fact, that the shell is sinistral (ultra-dextral), while the animal exhibits a right-handed organisation.

The gonad consists of very numerous small follicles, occupying the whole initial portion of the visceral mass. The penis includes a rounded horn piece, as in all "Pteropoda". — On the left side of the stomach I have found a gastric caecum, which is perhaps the same as the "bile duct", mentioned by PELSENEER (Pl. I, fig. 2).

The central nervous system is asymmetrical, the right portion of the visceral mass being larger than the left. PELSENEER was the first who discovered this asymmetry, not only in this case, but in all the genera of the Thecosomata.

The supra-oesophageal commissure is attached to the median side of the right cerebral ganglion (Pl. I, fig. 3 *C*).

Though I have often sought for the second pedal commissure, I have not found it. Only once I could see a small nerve (?) parting from the front of one of the pedal ganglia and directed towards the other, but even in this case I have not been able to decide whether this was a real commissure, or perhaps only a part of the very thin connective layer on the ganglia.

The otocysts are easily visible, owing to a brown pigment at the margins.

As to the nerves which part from the central nervous system I noted two nerves proceeding from the anterior part of the cerebral ganglia (not one, as PELSENEER has figured) [5]). In any other respect I agree entirely with PELSENEER; only the right pallial nerve was stronger than the left (Pl. I, fig. 3 *A*, *B*, *C*).

Auditory nerves I have not seen.

Peraclis Forbes (emend.).

1836. *Heliconoides (part.)* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 174.
1840. *Spirialis (part.)* Eydoux et Souleyet, Description sommaire de plusieurs Ptéropodes nouveaux ou imparfaitement connus, Revue Zoölogique, vol. III, p. 235.
1844. *Peracle* Forbes, Report on the Mollusca and Radiata of the Algean Sea, and on their distribution, considered as bearing on Geology, Rep. Brit. Ass. 1843, p. 186.

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1) Challenger Rep. LXVI, p. 7—11. It must have been a *lapsus calami*, that the author says (p. 7): "head distinct", this being indistinct.

2) Mollusca regionis arcticae Norvegiae, pl. 29, fig. 1, pl. XVI, fig. 17. Notwithstanding SARS denies the existence of jaws in *Limacina*, saying (p. 328): "maxillae nullae".

3) Spolia atlantica, pl. III, fig. 22.

4) Op. cit. Pl. I, figs. 1—8.

5) Op. cit. s. Pl. I, fig. 7.

1847. *Campylonaus* Gray, A List of the Genera of recent Mollusca, their synonyms and types, Proc. Zool. Soc. Lond., 1847, p. 149.
1858. *Euromus* A. and H. Adams, The Genera of recent Mollusca, vol. II, p. 613.
1876. *Limacina (part.)* Jeffreys, New and peculiar Mollusca of the family Eulimidae and other families of Gastropoda, as well as of the Pteropoda procured in the "Valorous" Expedition, Ann. and Mag. Nat. Hist. (4), vol. XIX, p. 337.

1. *Peraclis reticulata* (d'Orbigny) var. *minor* n. v. (Pl. I, fig. 4).

Living animal:
Stat. 243. 4° 30'.2 S., 129° 25' E. 3 spec.

Description: Shell almost entirely agreeing with the description, given by PELSENEER [1]). Four whorls, rapidly increasing, the last turn very large; reticulation hexagonal, becoming less marked towards the aperture, where it entirely disappears. The prolonged rostrum is bent forward.

Colour: Yellowish-red (spirit-specimen).

Dimensions: Height 1,25 mm.; max. diameter 1 mm.

Operculum: Transparent, with six coils, rounded, left-handed.

Animal: Head on a short proboscis, lips united ventrally; tentacles without sheath, and symmetrical. Fins broad, truncated, without tentacular lobe, posterior lobe of the foot broad at the base.

It is only with hesitation that I can make up my mind to regard the specimens of the Siboga-Expedition as a variety of the type. Comparing accurately the description and the figures of PELSENEER with the foregoing, there may be found only the following differences:

I. The chief one is the difference in dimensions. PELSENEER notes: maximum length 4 mm.; diameter 2,3 mm. The specimens of D'ORBIGNY [2]) and those of SOULEYET [3]) which were 2 mm. high, have been regarded by PELSENEER as young individuals, though D'ORBIGNY notes, notwithstanding the small size, four whorls in the spiral, and moreover that the reticulation is often not seen towards the aperture.
II. The operculum has six coils, not four. It corresponds entirely with BOAS' figure [4]), if this be regarded as seen from the inside.
III. The apex is more obtuse than in PELSENEER's figure, the first turn being almost in the same plane as the second.
IV. The inner lip of the aperture is very thin.

Though readily consenting that the differences from the type are very insignificant, I do not believe that the Siboga-specimens are quite identical with it. Particular attention must be paid to the genus *Peraclis*, being the most important among the Thecosomata.

2. *Peraclis rissoides* n. sp. (Pl. I, figs 5, 6, 11, 13, 14).

Living animal:
Stat. 243. 4° 30'.2 S., 129° 25' E. 1 spec.

Description: Shell as in *Peraclis reticulata* var. *minor*, that is to say: apex obtuse,

1) Challenger Rep. LXV, p. 34, pl. I, figs. 7—8.
2) Voyage dans l'Amérique méridionale, vol. V, p. 178.
3) Voyage de la Bonite, vol. II, p. 220. Pl. 13, figs 17—19.
4) Spolia atlantica. Pl. III, fig. 39*bis*.

surface reticulated, while the hexagonal sculpture disappears towards the aperture. But there are four and a half whorls, increasing more regularly. The rostrum being broken off, I could not make out its form. No umbilicus.

Colour: Yellowish-red (spirit-specimen).

Dimensions: Height 1,75 mm.; max. diam. 1,40 mm.

Operculum: Transparent, rounded, left-handed, six coils.

Animal: Quite as the above described variety of *Peraclis reticulata*. A strongly developed "balancer" on the right side of the mantle makes me think, that the rostrum must be long, probably curved in the same direction as in *Peraclis reticulata* var. *minor*.

The characters of the shell differ sufficiently from that of *Peraclis reticulata* to regard this form as a distinct species. Indeed, the shell is smaller, having four and a half whorls in its spire; moreover these whorls increase gradually.

3. *Peraclis moluccensis* n. sp. (Pl. I, figs. 7, 8, 9, 10).

Living animal:
Stat. 243. 4° 30'.2 S., 129° 25' E. 1 spec.

Description: Shell transparent, surface without reticulation, but with slightly marked rays on the deep suture, especially on the last whorl. Spire extremely short, four and a half whorls. The first turns rolled up in the same plane, and entirely covered (shell being seen from the aperture) by the very strongly bulging last whorl, which exhibits on the dorsal margin of the aperture a tooth, directed towards the apex, and curved in the direction of the last whorl; this tooth is supported by a thick rib. Between this rib and the suture the rays are especially strong. Rostrum straight, not curved. No umbilicus.

Colour: None, the animal being seen through the thin shell (spirit-preservation).

Dimensions: Height 0,80 mm.; max. diam. 1,20 mm.

Operculum: Glassy, rounded, about four whorls, left-handed.

Animal: The only information I can give about the animal is, that this species undoubtedly belongs to the genus *Peraclis*, as I have noted a short proboscis, the lips, surrounding the mouth, uniting ventrally, and two symmetrical tentacles of the same size and without sheath.

A short time after the single specimen had been figured, the shell was unfortunately quite crushed into small fragments, and the animal became so seriously damaged, that I had to abstain from further investigation. What I could observe about the animal, has been mentioned above.

Though greatly regretting the accident which prevented me from giving a more complete description, I hope the peculiarities of the shell will be sufficient to distinguish this species from other forms.

Peraclis moluccensis has evidently some affinity with *Peraclis bispinosa* (Pelseneer)[1]) but differs from it in being much smaller[2]), in the very depressed spire, and in the tooth which

1) Challenger Rep. LXV, p. 36, figs 9—10.
2) The dimensions of *P. bispinosa* are: length 7,5 mm., diameter 6 mm.

is stronger and not directed outwards. Nor is "*Spirialis diversa*" Monterosato [1]) identical with one of the above-named forms.

The smoothness of the shell shows that the reticulation does not occur always among the species of this genus.

Anatomical Notes.

The organisation of the genus *Peraclis*, being known by a single representative *(P. reticulata)* until now, has only been studied by PELSENEER [2]). The differences from *Limacina* are very striking, and these differences connect *Peraclis* with the Cymbuliidae. This is a fact of great importance and of the utmost value, as regards the phylogenetic affinities among the genera of the Thecosomata [3]).

I shall restrict myself to my own researches.

The head is situated on a short proboscis (Pl. I, fig. 11), rising from the dorsal margin of the fins; the lips unite ventrally, as well as dorsally, and have thickened walls; tentacles very small, symmetrical, situated on the same transverse line, and without sheath.

Foot: The posterior lobe of the foot is short, with broad base, and scarcely notched in the middle of its free margin. The fins are broad, without tentacle-like lobe; at their distal extremity they exhibit a shallow sinuosity; the ventral margin of the fins is situated more distally than the dorsal one, the inclination of the swimming organs with regard to the body therefore differing about 90° from that of *Limacina*.

Mantle: The pallial gland exhibits transverse bands, and was found to be symmetrical [4]). In the shield, seen from within, I noticed an elongated organ, which is perhaps the heart. On the right side of the mantle rises a long "balancer", whose insertion is somewhat pyriform.

(The description of the mantle refers only to *Peraclis rissoides*; other forms I have not examined in this respect).

Digestive Tract: There are two salivary glands, visible by a whitish colour on the brown oesophagus. At the entrance of the digestive tract I noticed two lateral jaws, especially developed towards the ventral side. Each jaw consists of four transverse series of horny teeth; the teeth towards the median and ventral side carry numerous hooks, more obtuse and less in number (*Peraclis reticulata* var. *minor*, Pl. I, fig. 12). The difference between the ventral teeth and the lateral ones is most distinct on the first transverse row and becomes gradually less distinct on the following series. Every row is inserted on a strong transverse muscular band. To my opinion, the jaws of *Peraclis* differ from those of *Limacina* in being stronger [5]).

As to the radula, I have not noticed anything remarkable; it is quite the same as in *Limacina*.

The oesophagus is extremely short. Further information may be found in PELSENEER's work. The extreme smallness of the animals did not permit me to study their organisation at

1) Nuova revista, etc., Atti Ac. sc. lett. ed arti, vol. V, p. 50. A good description with figures is given by LOCARD Exp. sc. Travailleur et Talisman, Moll., vol. II, p. 29, pl. I, figs. 4—6.

2) Challenger Rep. LXVI, p. 11—12.

3) Ibid., p. 28—37.

4) PELSENEER (op. cit.) remarks that the pallial gland is asymmetrical in *Peraclis reticulata*, as in *Limacina*.

5) SARS, Mollusca regionis arcticae Norvegiae, Pl. XVI, fig. 17*b*.

full account. Neither did I study the generative organs, nor the excretory apparatus. The organ on the roof of the pallial cavity, which is probably the heart, has been mentioned already.

Central nervous system: It differs very strikingly from that of *Limacina* and is almost identical, as regards the ganglia, with that of *Cymbulia*. I can only confirm PELSENEER's discovery, after having studied the nervous system of *Peraclis rissoides* (Pl. I, fig. 14). The pedal and cerebral ganglia are symmetrical, but instead of the asymmetrical visceral mass, occurring in *Limacina*, there are "three ganglia, the two lateral of which are symmetrical and a little smaller than the central one". With these words I agree entirely, only I found scarcely any difference in size between the three visceral ganglia.

Furthermore I have seen (1) a tentacular nerve issuing from the anterior part of the cerebral ganglia (B), (2) the nerves to the fins and to the posterior lobe of the foot (A), proceeding from the pedal ganglia, (3) a nerve proceeding from the right visceral ganglion (like PELSENEER, I could not find one on the left), and (4) two visceral nerves from the median visceral ganglion, one of them issuing almost median, the other from the right side of the ganglion (A, 4, 5).

The buccal ganglia, close to the oesophagus, are connected by a commissure.

Geographical Distribution.

Peraclis reticulata, first discovered by D'ORBIGNY [1]), who considered it to be a Heteropod, and several times found again by other investigators, seems to be very rare, though living over a wide area. Living animals were caught in the Pacific Ocean (D'ORBIGNY, SOULEYET, BOAS) and in the Mediterranean, (PELSENEER, OBERWIMMER), while the occurrence of the species in the Atlantic is somewhat doubtful, though the empty shells (without reticulation) have been recorded through deep-sea dredgings [2]), even from the North-Atlantic. The Challenger Expedition found *Peraclis reticulata* in the Atlantic only represented by deposit shells.

Its occurrence in the East-Indian Archipelago was to be expected, as it has been found in the Pacific Ocean (though in the eastern part) [3]) by D'ORBIGNY, BOAS (Chierchia Expedition) and PELSENEER (Challenger Expedition). Pelagic animals being generally distributed over wide areas, the variability in characters among the individuals of the same species is greater than in organisms, strictly localised by their mode of life. An attentive examination of a number of individuals from different stations will probably show some variations.

Peraclis bispinosa [4]), recorded from the Atlantic by the Challenger Expedition and from the Mediterranean [5]), is only known by its shell. The same is true of "*Spirialis diversa*" [6]) Monterosato, found in the Atlantic.

The two new species in the Siboga-material, *Peraclis rissoides* and *Peraclis moluccensis*,

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1) Voyage dans l'Amérique méridionale, vol. V, p. 174, figs. 32—35, 39.

2) As to the synonymy, see PELSENEER, Chall. Rep. LXV, p. 32.

3) SOULEYET (Voyage de la Bonite, vol. II, p. 221) has not noted a distinct locality; he says only: "dans l'Océan Pacifique".

4) PELSENEER, Chall. Rep., LXV, p. 36, pl. I, figs. 9—10.

5) OBERWIMMER, in Denkschr. K. Akad. Wiss. Wien, Bd. LXV, p. 589.

6) Nuova revista etc., in Atti Acad. sc. lett. ed arti, vol. V, p. 50. This species was referred by PELSENEER to *Peraclis bispinosa* (though with some doubt, as the description of DE MONTEROSATO is insufficient). It seems, however, a well defined species of *Peraclis* (though with deep umbilicus!), according to LOCARD, Expéditions scient. Travailleur et Talisman, Moll. test., vol. II, p. 29, pl. I, figs. 4—6.

seem to be rare, each of them being represented by a single specimen only. It is a remarkable fact, however, that the five specimens of *Peraclis* were obtained from one single station, off Banda (Stat. 243).

Limacina triacantha [1]) (Fischer) is perhaps a species of *Peraclis* too.

Appendix to the Limacinidae.

To the family Limacinidae some forms have been referred by several naturalists, which do not even belong to the Thecosomata. The "species" were based on minute shells, which sometimes exhibited a right-handed spire. Most of these "new" forms, however, had already disappeared, when PELSENEER began his task of criticizing the species of the "Pteropoda". This author showed [2]) that species of the genus "*Agadina*" were only larvae of streptoneural Gastropods, while at the same time he designated "*Limacina turritelloides*" Boas [3]), as a young *Triforis*.

Having found among the spoils of the Siboga several sinistrorsal shells, evidently not belonging to "Pteropods", I think it to be of some use to discuss them.

1. "*Limacina turritelloides*" Boas.

1887. *Limacina turritelloides* Boas, Spolia atlantica, p. 49—50, Pl. III, fig. 35.
1898. *Sinusigera turritelloides* Oberwimmer, Denkschr. Kais. Akad. Wien, Bd. LXV, p. 592.

Living animals:
Stat. 148. 0° 17'.6 S., 129° 14'.5 E. 4 spec.
Stat. 222. 6° 10' S., 125° 35'.5 E. 6 spec.

It has been with some doubt that BOAS [3]), who could only study the shell, has regarded this form as a *Limacina*. With much authority however, this opinion was rejected by PELSENEER [4]), who also had only empty shells at his disposal. According to him this "*Limacina turritelloides*" was a young *Triforis*, identical with "*Sinusigera perversa*" Craven [5]). MUNTHE [6]), whose paper appeared only a few months before PELSENEER's work, maintained the species of BOAS as being a distinct form.

The study of the animals themselves has shown me, that they are real larvae. I noticed a broad foot and a four-lobed velum. The operculum, inserted to the posterior end of the foot, has a large nucleus, the coils have a right-handed direction and increase slowly.

The type on which the genus *Agadina* Gould [7]) has been based, was referred by PELSENEER [8]) to *Limacina antarctica*, though GOULD's figure exhibits a right-handed spiral. GOULD himself erected the genus "*Agadina*" for his "*Limacina cucullata*".

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1) Journ. de Conch., vol. XXX, p. 49.
2) Challenger Rep., LXV, p. 37—40.
3) Spolia atlantica, p. 49—50, Pl. III, fig. 35.
4) Op. cit. s. p. 40.
5) Ann. Soc. Malacol. Belg., vol. XVIII, p. 26.
6) Pteropoder i Upsala Universitets Zoölogiska Museum, Bihang til K. Svenska Vet. Akad. Handlingar. Bd. 13, afd. IV, n° 2.
7) U. S. Exploring Expedition under the command of WILKES, 1852. Vol. XII, p. 486, Pl. LI, figs 601*a*, *b*.
8) Challenger Report, LXV, p. 37.

After 15 years A. ADAMS [1]) described as two new species of *Agadina*, two forms, the shells of which are, however, really sinistral.

The Challenger-material has given occasion to PELSENEER to show, that these "species" of ADAMS (and still another *Agadina*-form found by the Challenger) were only Gastropod larvae.

The Siboga has also collected some "species" of *Agadina*.

1. "*Agadina*" *stimpsoni* A. Adams.

1867. *Agadina stimpsoni* A. Adams, Description of new species of Shells from Japan, Proc. Zool. Soc. London, 1867, p. 309, pl. XIX, fig. 23.

Living animals:

Stat. 213.	5° 54'.5 S., 120° 19'.2 E.	1 spec.
Stat. 215a.	6° 30' S., 121° 55' E.	2 spec.
Stat. 225.	Near the Lucipara Islands.	1 spec.
Stat. 243.	4° 30'.2 S., 129° 25' E.	2 spec.
Stat. 245.	4° 16'.5 S., 130° 15'.8 E.	1 spec.
Stat. 282.	8° 25'.2 S., 127° 18'.4 E.	1 spec.
Stat. 304.	Lomblen Island.	1 spec.

The bell-shaped margins of the shell are slightly brown-coloured. I stated, as PELSENEER has done too, that this *Agadina*-form is only a larva, as I found a four-lobed velum on the head, and a broad foot, which carries the operculum.

2. "*Agadina*" n. sp. (Pelseneer).

1888. *Agadina* n. sp. Pelseneer, Pteropoda Thecosomata. Challenger Rep. LXV, p. 39, pl. I, figs. 15—16.

Stat. 157.	0° 32'.9 S., 130° 14'.6 E.	1 spec.
Stat. 213.	5° 54'.5 S., 120° 19'.2 E.	1 spec.
Stat. 225.	Near Lucipara Islands.	1 spec.

I myself did not study the animal, but according to PELSENEER, it carries on its head a four-lobed velum and is doubtless a Gastropod-larva.

Another *Agadina*-form may be mentioned here.

3. "*Agadina*" n. sp. (Pl. I, fig. 15).

Stat. 215a. 6° 30' S., 121° 55' E. 1 spec.

The shell is left-handed, entirely transparent, with somewhat thickened margins; suture well marked, deep; three whorls, spire somewhat projecting beyond the last whorl. Deep umbilicus, as in "*Agadina*" *stimpsoni*, but without rays.

Operculum, quite as in "*Agadina*" *stimpsoni*: left-handed, many turns slowly increasing.

Animal with a four-lobed velum on its head.

Dimensions: Height 0,75 mm.; max. diam. 1 mm.

1) Proc. Zool. Soc. London 1867, p. 309.

The shells of these larval forms are minute, left-handed, sometimes transparent; so there is some resemblance with the shells of Limacinidae, but the thickened margins of "*Agadina*" form the difference. Besides, the operculum in "*Agadina*" is horny and not thin and glassy as in the Limacinidae; it has a large nucleus, left-handed, and is attached more strongly to the foot by means of a knob. Another difference from the Limacinidae is the fact that the operculum, very distinctly concave at the outside, is circular and not more or less semilunar.

H. Simroth [1]) made already known several larvae with a left-handed shell, about which it is very difficult to decide to what genus they must be referred. Perhaps they belong to marine streptoneural Gastropods with a right-handed spire, but the initial portion of which is coiled to the left, as it has been suspected by Pelseneer [2]). The operculum is left-handed, and besides, the beginning of its spiral is turned to the columella, as occurs in ultra-dextral forms.

Family II. Cavoliniidae.

1841. *Hyalidae (part.)* d'Orbigny, in: Histoire physique, politique et naturelle de l'île de Cuba, par Ramon de la Sagra, Mollusques, vol. I, p. 70.
1842. *Cavolinidae* d'Orbigny, Paléontologie française, Terrains cretacés. vol. II, p. 4.
1842. *Cleodoridae* Gray, Synopsis of the contents of the British Museum, p. 92.
1854. *Hyalaeacea* Troschel, Beiträge z. Kenntn. der Pteropoden. Arch. f. Naturgesch., Jahrg. XX, p. 196.
1856. *Hyaleidae (part.)* Woodward, Manuel of the Mollusca (2nd Edit. p. 348).
1869. *Cliidae* Jeffreys, British Conchology, vol. V, p. 118.
1875. *Orthoconques* Fol, Sur le développement des Ptéropodes, Arch. d. Zoöl. exp., sér. 1, vol. IV, p. 177.
1885. *Hyalaeidae* Boas, Spolia atlantica, Bidrag til Pteropodernes Morfologi og Systematik samt til Kundskaben om deres geografiske Udbredelse, Vidensk. Selsk. Skr., 6. Raekke, IV, 1. p. 51.
1888. *Cavoliniidae* Pelseneer, Challenger Rep. LXV, p. 41.
incl. *Cuvieridae* Gray, 1842 = *Tripteridae* Gray, 1850.

This family formerly included many more genera, than really belong to it. D'Orbigny (see the list above) classed all the Thecosomata, with which he was acquainted, among his Hyalidae (also *Cymbulia* and *Limacina*) and Souleyet [3]) referred to his "famille des Hyales" also *Limacina* and "*Spirialis*", while Woodward (see above) included in his family: *Euribia* Rang (= *Halopsyche* Bronn), *Cymbulia* and *Tiedemannia* Delle Chiaje (= *Gleba* Forskål).

Boas and Pelseneer, however, have defined more strictly the limits of the Cavoliniidae. The forms, composing this family, are characterised by their external, calcareous, bilaterally-symmetrical shell [4]), which is not coiled, but in some cases straight, in others provided with a

1) Die Gastropoden der Plankton-Expedition 1895.
2) Challenger Rep. LXV, p. 40.
3) Histoire naturelle des Mollusques Ptéropodes, p. 32.
4) Some asymmetry in the shell is found in *Clio (Styliola) subula*, in "*Cleodora*" *Schéelei* Munthe (Pteropoder i Upsala Universitets zoologiska Museum, Bihang till K. Svenska Vet. Akad. Handlingar, Bd. 13, afd. IV, n° 2, p. 18—19, fig. 15), and in "*Pleuropus hargeri*" Verrill (Catalogue of Marine Mollusca added to the fauna of the New England region, during the past ten years, Transactions Connectic. Acad. vol. V, prt. 2, 1882, p. 555).

dorsally curved apex. An embryonic shell (FOL) is often distinguished from the rest. The animal has a ventral pallial cavity and a dorsal columellar muscle. The flexure of the intestine is ventral. The anus situated on the left side; in the central nervous system the left portion of the visceral mass is more developed than the right.

The affinity of the Cavoliniidae with the Limacinidae has been discussed before.

Three distinct genera can only be admitted among the various species, though formerly a great number of generic titles has been used [1]).

These genera are: *Clio*, *Cuvierina* and *Cavolinia*.

The genus *Clio* includes four subgenera:

Creseis, *Hyalocylix*, *Styliola*, *Clio (s. str.)*.

Cuvierina was regarded by GRAY [2]) as a genus, representing a separate family; however, it clearly belongs to the Cavoliniidae.

Cavolinia consists of two subgenera:

Diacria, *Cavolinia (s. str.)*.

According to PELSENEER, fourteen species of *Clio* may be distinguished. However, I cannot regard *Clio conica* as a distinct form, as I shall explain further on. MUNTHE has described a new species of *Clio* (see note 1), so that the number of species is fourteen. Six of them were obtained by the Siboga. I cannot discuss the specific distinctness of the species which form the subgenus *Clio (s. str.)*, as I could only observe two species.

As to the genus *Cuvierina* it includes only a single species. This species was represented in the Siboga-material by a few empty shells only.

The eight species of *Cavolinia* are all included in the Siboga-collection.

New forms have not been found.

Clio Linné.

1756. *Clio* Browne, The civil and natural History of Jamaica, p. 386.
1767. *Clio* Linné, Systema naturae, ed. 12, vol. I, prt. 2, p. 1094.
1810. *Cleodora* Péron and Lesueur, Histoire de la famille des Mollusques Ptéropodes, Ann. Mus. Hist. Nat. Paris, vol. XV, p. 66.
1825. *Styliola* Lesueur, in: DE BLAINVILLE, Manuel de Malacologie, p. 655.
1828. *Creseis* Rang, Notice sur quelques Mollusques nouveaux appartenant au genre Cleodora, et établissement et monographie du sous-genre *Creseis*, Ann. d. Sc. Nat. sér. 1, vol. XIII, p. 302.
1837. *Balantium* Benson, Notice on *Balantium*, a Genus of the Pteropodous Mollusca, Journ. Asiat. Soc. Bengal, vol. VI, p. 151.
1875. *Hyalocylix* Fol, Sur le développement des Ptéropodes, Arch. d. Zool. Exp., vol. IV, p. 177.

Subgenus *Creseis* Rang *(s. str.)*.

1828. *Creseis (part.)* Rang, Notice sur quelques Mollusques nouveaux, etc., Ann. d. Sc. Nat. sér. 1, vol. XIII, p. 302.
1828. *Styliola (part.)* Auctorum.

1) As to the different generic names, see PELSENEER, Chall. Rep. LXV, p. 41.
2) Catalogue of the Mollusca in the collection of the British Museum. Prt. II, Pteropoda, p. 23.

1. *Clio (Creseis) virgula* (Rang.)

1828. *Creseis virgula, clava* Rang, Notice, etc. Ann. d. Sc. Nat. sér. 1, vol. XIII, p. 316—317, pl. XVII, fig. 2, 5.
1829. *Creseis conica, unguis, cornucopiae, caligula* Eschscholtz, Zool. Atl., Heft III, p. 17—18, pl. XV, figs. 3—6.
1830. *Creseis striata* Delle Chiaje, Memorie sulla storia e notomia degli animali senza vertebre, pl. LXXXII, fig, 12.
1836. *Hyalaea corniformis* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 120, pl. VIII, figs. 20—23.
1850. *Styliola virgula* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 17.
1850. *Styliola corniformis* Gray, Ibid., p. 18.
1852. *Cleodora virgula* Souleyet, Voyage de la Bonite, Zool., vol. II, p. 196, pl. VIII, figs. 18—25.
1852. *Cleodora munda, placida, falcata* Gould, The Mollusca and Shells of the U. S. Exploring Expedition under the command of WILKES, p. 489—490, Pl. LI, figs. 607 *a*, *b*, 606 *a*, 608 *a*.
1869. *Creseis conica* A. Costa, Pteropodi del golfo di Napoli, Rendiconto d. reale Accad. d. Sci. Napoli, p. 58.
1872. *Styliola vitrea* Verrill, Recent Additions to the Molluscan fauna of New England and the adjacent waters, etc. Amer. Journ. Sci. and Arts, vol. III, p. 284, pl. VI, fig. 7.
1873. *Creseis conoidea* A. Costa, Pteropodi della Fauna del Regno di Napoli, p. 17, pl. IV, fig. 6.
1879. *Cleodora flexa* Pfeffer, Bericht über die von S. M. SCHIFF "Gazelle" und Dr. JAGOR gesammelten Pteropoden, Monatsber. d. k. pr. Ak. d. Wiss. Berlin, p. 241, figs. 15—16.
1888. *Clio (Creseis) virgula* Pelseneer, Chall. Rep. LXV, p. 48.
1888. *Clio (Creseis) conica* Pelseneer, Ibid., p. 50, pl. II, figs. 1—2.

Living animals:

Stat. 2.	7° 27′.5 S., 113° 8′.5 E.	3 spec.
Stat. 35.	8° 0′.3 S., 116° 59′ E.	2 spec.
Stat. 36.	7° 38′ S., 117° 31′ E.	6 spec.
Stat. 75.	4° 57′.4 S., 119° 2′.8 E.	4 spec.
Stat. 96.	Pearl-bank, Sulu Archipelago.	12 spec.
Stat. 98—99.	6° 9′ N., 120° 21′ E.	± 20 spec.
Stat. 106.	Kapul Island, Sulu Archipelago.	± 70 spec.
Stat. 109.	Pulu Tongkil, Sulu Archipelago.	10 spec.
Stat. 110.	4° 34′ N., 122° 0′ E.	6 spec.
Stat. 112.	3° 1′ N., 122° 2′ E.	3 spec.
Stat. 117a.	1° 15′ N., 123° 37′ E.	18 spec.
Stat. 121.	Menado.	1 spec.
Stat. 128.	4° 27′ N., 125° 25′.7 E.	10 spec.
Stat. 130.	5° 0′ N., 125° 26′.5 E.	± 20 spec.
Stat. 136.	Ternate.	± 25 spec.
Stat. 138.	Kajoa Island.	± 20 spec.
Stat. 143.	1° 4′.5 S., 127° 52′.6 E.	1 spec.
Stat. 144.	Damar Island.	± 20 spec.
Stat. 146.	0° 36′ S., 128° 32′.7 E.	2 spec.
Stat. 148.	0° 17′.6 S., 129° 14′.5 E.	5 spec.
Stat. 149.	Gebé Island.	5 spec.
Stat. 156.	0° 29′.2 S., 130° 5′.3 E.	2 spec.
Stat. 165.	Daram Island.	± 50 spec.
Stat. 169.	Atjatuning.	8 spec.
Stat. 172.	Between Gisser and Ceram-Laut.	5 spec.
Stat. 174.	Waru Bay (Ceram).	4 spec.

Stat. 177ª.	2° 30′ S., 129° 28′ E.	8 spec.
Stat. 184.	Kampong Kelang.	2 spec.
Stat. 185.	Manipa Strait.	8 spec.
Stat. 193.	Sanana Bay, Sula Besi.	4 spec.
Stat. 194—197.	1° 53′ S., 127° E.	8 spec.
Stat. 203.	3° 32′.5 S., 124° 15′.5 E.	6 spec.
Stat. 205.	Lohio Bay, Buton Strait.	10 spec.
Stat. 210ª.	5° 26′ S., 121° 18′ E.	2 spec.
Stat. 215ª.	North-point of Kabia Island.	15 spec.
Stat. 220.	Pasir Pandjang, Binongka.	± 20 spec.
Stat. 223.	5° 44′.7 S., 126° 27′.3 E.	17 spec.
Stat. 224.	5° 34′ S., 127° 4′ E.	5 spec.
Stat. 225.	Near the Lucipara Islands.	2 spec.
Stat. 276.	6° 47′.5 S., 128° 40′.5 E.	2 spec.
Stat. 315.	Sailus Besar, Paternoster Islands.	16 spec.

From this long list of stations it results that this species is most abundant in the East-Indian Archipelago. Together with the following species, it is certainly by far the most common form in this region.

The numerous variations in form, according to which many different titles have been used, will be discussed further on.

2. *Clio (Creseïs) acicula* (Rang).

1828. *Creseis acicula* Rang, Notice sur quelques Mollusques nouveaux, etc. Ann. d. Sc. Nat. sér. 1, vol. XIII, p. 318, pl. XVII, fig. 6.
1829. *Creseis acus* Eschscholtz, Zool. Atl. Heft III, p. 17, Pl. XV, fig. 2.
1836. *Hyalaea aciculata* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 123, pl. VIII, figs. 29—31.
1850. *Styliola recta* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 18.
1852. *Cleodora acicula* Souleyet, Voyage de la Bonite, Zool., vol. II, p. 194, pl. VIII, figs. 10—17.
1888. *Clio (Creseis) acicula* Pelseneer, Chall. Rep. LXV, p. 51.

Living animals:

Stat. 1.	7° 27′.5 S., 113° 8′.5 E.	± 30 spec.
Stat. 2.	7° 25′ S., 113° 16′ E.	7 spec.
Stat. 35.	8° 0′.3 S., 116° 59′ E.	± 15 spec.
Stat. 37.	Sailus Ketjil, Paternoster Islands.	± 40 spec.
Stat. 47ª.	Batu Putih, entrance Bay of Bima.	1 spec.
Stat. 50.	Bay of Badjo, West-coast of Flores.	± 25 spec.
Stat. 66.	Between Bahuluwang and Tambolungan.	45 spec.
Stat. 71.	Makassar.	11 spec.
Stat. 89.	Pulu Kaniungan Ketjil.	12 spec.
Stat. 96.	Pearl-bank, Sulu Archipelago.	11 spec.
Stat. 99.	6° 7′.5 N., 120° 26′ E.	18 spec.
Stat. 104.	Sulu-harbour, Sulu Island.	± 30 spec.
Stat. 106.	Kapul-island, Sulu Archipelago.	20 spec.
Stat. 109.	Pulu Tongkil, Sulu Archipelago.	15 spec.
Stat. 110.	4° 34′ N., 122° 0′ E.	5 spec.
Stat. 112.	3° 1′ N., 122° 2′ E.	7 spec.
Stat. 117ª.	1° 15′ N., 123° 37′ E.	12 spec.
Stat. 118.	1° 38′ N., 124° 28′.2 E.	1 spec.

Stat. 122.	1° 58′.5 N., 125° 0′.5 E.	4 spec.
Stat. 125.	Sawan, Siau Island.	2 spec.
Stat. 128.	4° 27′ N., 125° 25′.7 E.	3 spec.
Stat. 130.	5° 0′ N., 125° 26′.5 E.	± 70 spec.
Stat. 136.	Ternate.	18 spec.
Stat. 138.	Kajoa Island.	17 spec.
Stat. 141.	1° 0′.4 S., 127° 25′.3 E.	14 spec.
Stat. 143.	1° 4′.5 S., 127° 52′.6 E.	± 30 spec.
Stat. 146.	0° 36′ S., 128° 32′.7 E.	2 spec.
Stat. 148.	0° 17′.6 S., 129° 14′.5 E.	5 spec.
Stat. 149.	Fau, West-coast of Gebé Island.	5 spec.
Stat. 157.	0° 32′.9 S., 130° 14′.6 E.	5 spec.
Stat. 165.	Daram Island.	± 15 spec.
Stat. 169.	Atjatuning, West coast of New-Guinea.	33 spec.
Stat. 172.	Between Gisser and Ceram-Laut.	1 spec.
Stat. 174.	Waru Bay, North coast of Ceram.	3 spec.
Stat. 177[a].	2° 30′ S., 129° 28′ E.	± 25 spec.
Stat. 185.	3° 20′ S., 127° 22′.9 E.	4 spec.
Stat. 189[a].	2° 22′ S., 126° 46′ E.	10 spec.
Stat. 193.	Sanana Bay, East coast of Sula Besi.	2 spec.
Stat. 194—197.	1° 53′ S., 127° 0′ E.	10 spec.
Stat. 203.	3° 32′.5 S., 124° 15′.5 E.	27 spec.
Stat. 205.	Lohio Bay, Buton Strait.	25 spec.
Stat. 210[a].	5° 26′ S., 121° 18′ E.	12 spec.
Stat. 213.	Saleyer.	5 spec.
Stat. 215[a].	North-point of Kabia Island.	3 spec.
Stat. 217.	6° 40′.6 S., 123° 14′.7 E.	25 spec.
Stat. 220.	Pasir Pandjang, West coast of Binongka.	± 35 spec.
Stat. 223.	5° 44′.7 S., 126° 27′.3 E.	9 spec.
Stat. 224.	5° 34′ S., 127° 4′ E.	± 40 spec.
Stat. 225.	Near the Lucipara Islands.	13 spec.
Stat. 243.	4° 30′.2 S., 129° 25′ E.	4 spec.
Stat. 245.	4° 16′.5 S., 130° 15′.8 E.	± 40 spec.
Stat. 252.	West-side of Faam Island.	9 spec.
Stat. 276.	6° 47′.5 S., 128° 40′.5 E.	15 spec.
Stat. 282.	8° 25′.2 S., 127° 18′.4 E.	12 spec.
Stat. 315.	Sailus Besar, Paternoster Islands.	± 50 spec.

A great number of specimens were caught; this species is perhaps more abundant than the foregoing one.

Creseis virgula and *Creseis acicula* exhibit many variations, and a large number of distinct "species" has been distinguished, as may be seen from the list of synonyms. Souleyet, however, already affirmed [1]) that the difference between *virgula* and *acicula* consisted only in the curvature of the shell, and Boas [2]), after examining a great number of both species from the Indian and Pacific Ocean, was of opinion that the forms *virgula* and *acicula* were only a single species. The dorsally curved shell of *virgula* passes so gradually into the straight shell of *acicula*, that it is almost impossible to say, where the limits are between the two species (See in his work, pl. 6, fig. 94).

1) Voyage de la Bonite, Zoölogie, vol. II, p. 196.
2) Spolia atlantica p. 61.

PELSENEER [1]) regarded *conica* as a transitional form between *virgula* and *acicula*. The differences among his three species are mentioned here summarily:

I. Shell. *A*. Initial portion of a dark brown colour.
a. Shell itself with very marked dorsal curve; transverse diameter rapidly increasing . . . . . *Clio virgula*.
b. Shell slightly curved; the transverse diameter increases gently and uniformly. . . . . *Clio conica*.
B. Posterior extremity whitish.
Shell long, slender, straight . . . . . *Clio acicula*.

II. Animal. *A*. Oesophagus very long; for that reason stomach and liver situated much behind. . . . . *Clio virgula*.
B. Oesophagus short.
a. Liver distinct . . . . . *Clio conica*.
b. Liver much reduced . . . . . *Clio acicula*.

I. As to the shell, I have seen a very great number of forms, and I agree with BOAS, that the limits between *virgula* and *acicula* are scarcely visible. The forms *corniformis*, *virgula*, *conica*, *clava*, *acicula* merge into one another. Besides, many specimens of *acicula* have a brown-coloured embryonic shell.

II. I did not find the oesophagus in *conica* and in *acicula* short, neither can I attach any great importance to the liver, which is present, even in the very long *acicula*-specimens. I think that the anatomical differences vary gradually with the curvature of the shell.

The difference between *clava* and *acicula*, though slight, is somewhat greater than between the other forms. Though *clava* was referred by SOULEYET, by BOAS and by PELSENEER to *acicula*, I believe it belongs to *virgula*.

Therefore I have referred all the forms with a curved shell *(corniformis*, *virgula*, *conica)* to the species *virgula*. Also the very short straight form *clava*.

On the other hand I have referred the specimens with very long, slender, straight shells to the species *acicula*. *Styliola vitrea* was referred by BOAS to *Creseis virgula*, by PELSENEER to *Creseis conica*. The figure of VERRILL shows the fins rounded, but this is most probably a mistake.

The extremity of the shell in *virgula* and *acicula* shows two very slight constrictions, the anterior of which, tolerably distinct in the first species, gradually disappears in *acicula* (See BOAS, Spol. atl. figs. 40—33).

Subgenus *Hyalocylix* Fol.

1828. *Creseis (part.)* Rang, Notice sur quelques Mollusques nouveaux etc., Ann. d. Sc. Nat., sér. 1, vol. XIII, p. 302.
1875. *Hyalocylix* Fol, Sur le développement des Ptéropodes, Arch. d. Zoöl. Exp., sér. 1, vol. IV, p. 177.
1875. *Styliola (part.)* Auctorum.
1875. *Cleodora (part.)* Auctorum.

1) Chall. Rep. LXV, p. 50.

3. *Clio (Hyalocylix) striata* (Rang).

1828. *Creseis striata* Rang, Notice sur quelques Mollusques etc., Ann. d. Sc. Nat., sér. 1, vol. XII, p. 315, pl. XVII, fig. 3.
1829. *Creseis compressa* Eschscholtz, Zool. Atl., Heft III, p. 17, pl. XV, fig. 7.
1830. *Creseis zonata* Delle Chiaje, Memorie sulla storia e notomia degli animali senza vertebre, pl. LXXXII, fig. 9.
1836. *Hyalaea striata* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 122, pl. VIII, figs. 23—25.
1850. *Styliola striata* Gray, Catalogue of the Mollusca in the Collection of the British Museum, prt. II, p. 18.
1852. *Cleodora striata* Souleyet, Voyage de la Bonite, vol. II, p. 191, pl. VIII, figs. 1—4.
1854. *Creseis phaeostoma, monotis* Troschel, Beiträge zur Kenntniss der Pteropoden, Arch. f. Naturg., 20er Jahrg. p. 206—208, pl. VIII, figs. 5—9.
1888. *Clio (Hyalocylix) striata* Pelseneer, Chall. Rep. LXV, p. 54, pl. II, fig. 3.

Living animals:

Stat. 1.	7° 27'.5 S., 113° 8'.5 E.	1 spec.
Stat. 2.	7° 25' S., 113° 16' E.	6 spec.
Stat. 89.	Pulu Kaniungan Ketjil.	2 spec.
Stat. 96.	Pearl-bank, Sulu Archipelago.	3 spec.
Stat. 110.	4° 34' N., 122° 0' E.	3 spec.
Stat. 118.	1° 38' N., 124° 28'.2 E.	2 spec.
Stat. 128.	4° 27' N., 125° 25'.7 E.	1 spec.
Stat. 130.	5° 0' N., 125° 26'.5 E.	2 spec.
Stat. 136.	Ternate.	28 spec.
Stat. 138.	East coast of Kajoa Island.	2 spec.
Stat. 141.	1° 0'.4 S., 127° 25'.3 E.	2 spec.
Stat. 143.	1° 4'.5 S., 127° 52'.6 E.	2 spec.
Stat. 144.	Damar Island.	1 spec.
Stat. 146.	0° 36' S., 128° 32'.7 E.	1 spec.
Stat. 165.	Daram Island.	318 spec.
Stat. 168.	North of Sabuda Island.	14 spec.
Stat. 169.	Atjatuning, West coast of New-Guinea.	30 spec.
Stat. 174.	Waru Bay, North coast of Ceram.	1 spec.
Stat. 177a.	2° 30' S., 129° 28' E.	10 spec.
Stat. 185.	3° 20' S., 127° 22'.9 E.	9 spec.
Stat. 289a.	2° 22' S., 126° 46' E.	2 spec.
Stat. 205.	Lohio Bay, Buton Strait.	5 spec.
Stat. 243.	4° 30'.2 S., 129° 25' E.	1 spec.
Stat. 276.	6° 47'.5 S., 128° 40'.5 E.	2 spec.
Stat. 304.	Lomblen Island.	1 spec.

This species, though occurring in the whole East Indian Archipelago, was very abundant at some stations.

Among the specimens of stat. 169, one exhibited a peculiarity, which has been figured on Pl. II. fig. 16. The shell was somewhat constricted near the end, bluntly pointed, and not curved at all. Transverse ridges were scarcely visible on the posterior half of the shell. At the end, I remarked three or four longitudinal, irregular ridges. As to the animal, the fins, the posterior lobe of the foot and the two tentacles as well as the pallial gland did not show any difference from these organs in a normal *Hyalocylix*; I believe, therefore, it is only an anomaly.

The embryonic shell of this species is caducous; it has been figured, however, by FOL [1]) and by PELSENEER [2]). Like the latter I have seen it on an adult specimen, but as may be seen from the figure (Pl. I, fig. 17), I remarked two constrictions behind the partition, which separates the embryonic portion from the rest of the shell.

TROSCHEL (see the list of synonyms) has described and figured two "species", which to my opinion must be referred to *Clio striata*. Both these forms are young stages. TROSCHEL noted in "*Creseis phaeostoma*" the anus on the right side, but from his description it may be inferred, that he has mistaken the genital duct (if this really exists already in such young forms) for an intestine.

Subgenus *Styliola* Lesueur.

1825. *Styliola* Lesueur, in: DE BLAINVILLE, Manuel de Malacologie, p. 655.

4. *Clio (Styliola) subula* (Qoy and Gaimard).

1825. *Styliola recta* Lesueur, in: DE BLAINVILLE, Manuel de Malacologie, p. 655 (name only).
1827. *Cleodora subula* Qoy et Gaimard, Observations Zoologiques faites à bord de l'Astrolabe, etc., Ann. d. Sc. Nat., sér. 1, vol. X, p. 233, pl. VIII *D*, figs. 1—3.
1828. *Creseis spinifera* Rang, Notice sur quelques Mollusques nouveaux, etc., Ann. d. Sc. Nat., sér. 1, vol. XIII, p. 313, pl. XVII, fig. 1.
1828. *Creseis subula* Rang, Ibid., pl. XVIII, fig. 1.
1836. *Hyalaea subula* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 119, pl. VIII, figs. 15—19.
1850. *Styliola subula* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 17.
1852. *Cleodora subulata* Souleyet, Voyage de la Bonite, Zoologie, vol. II, p. 192, pl. VIII, figs. 5—9.
1852. *Styliola subulata* Fischer, Manuel de Conchyliologie, p. 437.
1888. *Clio (Styliola) subula* Pelseneer, Chall. Rep. LXV, p. 57.
1889. *Cleodora (Styliola) subulata* Dall, in Bull. U. S. Nat. Mus., vol. XXXVII, p. 80.

Living animals:

Stat. 110. 4° 34′ N., 122° 0′ E. 12 spec.
Stat. 128. 4° 27′ N., 125° 25′.7 E. 1 spec.
Stat. 148. 0° 17′.6 S., 129° 14′.5 E. 1 spec.
Stat. 177ª. 2° 30′ S., 129° 28′ E. 3 spec.
Stat. 185. 3° 20′ S., 127° 22′.9 E. 1 spec.

Clio subula has been recorded by the Siboga Expedition only from the Celebes Sea and the Ceram Sea. It does not seem to be very abundant.

Subgenus *Clio* Linné.

1767. *Clio* Linné, Systema Naturae, 12th ed., p. 1094.
1810. *Cleodora* Péron et Lesueur, Histoire de la Famille des Mollusques Ptéropodes, Ann. Mus. Hist. Nat. Paris, vol. XV, p. 66.
1829. *Balantium* Anonymous, Journ. Roy. Inst., vol. XV, p. 220.

1) Sur le développement des Ptéropodes, Arch. d. Zoöl. Exp., sér. 1, vol. IV.
2) Challenger Rep. LXV, p. 55, pl. II, fig. 3.

*5. *Clio balantium* (Rang).

1829. *Balantium recurvum* Anonymous, Journ. Roy. Inst., vol. XV, p. 220, pl. VII, fig. 107.
1834. *Cleodora balantium* Rang, Magasin de Zool. 1834, pl. XLIV.
1836. *Hyalaea balantium* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 116, pl. VII, figs. 1—4.
1837. *Balantium bicarinatum* Benson, Notice on *Balantium*, a Genus of the Pteropodous Mollusca, Journ. Asiat. Soc. Bengal, vol. VI, p. 151.
1852. *Cleodora inflata* Souleyet, Voyage de la Bonite, vol. II, p. 188, pl. VII, figs. 17—19.
1888. *Clio balantium* Pelseneer, Chall. Rep. LXV, p. 61.
1889. *Cleodora recurva* Dall, in: Bullet. U. S. Nat. Mus., n° 37, p. 82.

A young specimen was found by the Challenger, north of New-Guinea (2°56′ N., 134°11′ E.) I have not found this species among the spoils of the Siboga.

6. *Clio pyramidata* Linné (*non* Rang).

1767. *Clio pyramidata* Linné, Systema Naturae, 12th Ed., p. 1094.
1813. *Hyalaea lanceolata* Lesueur, Mémoire sur quelques espèces d'animaux mollusques et radiaires recueillis dans la Méditerranée près de Nice, Nouv. Bullet. d. Science par la Soc. Philom de Paris, vol. III, p. 284, pl. V, fig. 3.
1825. *Cleodora brownii* de Blainville, Dict. d. Sc. Nat. pl. 59, fig. 1.
1836. *Hyalaea pyramidata* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 113, pl. VII, figs. 30—32.
1852. *Cleodora lanceolata* Souleyet, Voyage de la Bonite, vol. II, p. 179, pl. VI, figs. 17—25.
1852. *Cleodora exacuta* Gould, The Mollusca and Shells of the U. S. Exploring Expedition u. the comm. of WILKES, vol. XII, p. 488, pl. LI, fig. 605.
1853. *Cleodora lamartinieri* d'Orbigny, Histoire physique, politique et naturelle de l'île de Cuba, par Ramon de la Sagra, Mollusques, vol. II, p. 83.
1877. *Cleodora labiata* Sowerby, in Reeve, Conchologia iconica, vol. XX, Pteropoda, fig. 26.
1880. *Cleodora martensii* Pfeffer, Die Pteropoden des Hamburger Museums, Abhandl. d. Naturw. Ver. Hamb., Bd. VII, p. 95, pl. VII, fig. 16.

Living animals:

Stat. 52.	9° 3′.4 S., 119°56′.7 E.	5 spec.
Stat. 59.	10°22′.7 S., 123°16′.5 E.	1 spec.
Stat. 88.	0°34′.6 N., 119° 8′.5 E.	8 spec.
Stat. 102.	6° 4′.1 N., 120°44′ E.	1 spec.
Stat. 139.	0°11′ S., 127°25′ E.	1 spec.
Stat. 141.	1° 0′.4 S., 127°25′.3 E.	1 spec.
Stat. 177a.	2°30′ S., 129°28′ E.	1 spec.
Stat. 178.	2°40′ S., 128°37′.5 E.	1 spec.
Stat. 185.	3°20′ S., 127°22′.9 E.	2 spec.
Stat. 203.	3°32′.5 S., 124°15′.5 E.	2 spec.
Stat. 211.	5°40′.7 S., 120°45′.5 E.	7 spec.
Stat. 212.	5°54′.5 S., 120°19′.2 E.	1 spec.
Stat. 225.	Near the Lucipara Islands.	5 spec.
Stat. 243.	4°30′.2 S., 129°25′ E.	2 spec.
Stat. 276.	6°47′.5 S., 128°40′.5 E.	1 spec.

This species, almost cosmopolitan, was also found at many stations. It is by far the most common form among the species of *Clio (s. str.)*.

Boas distinguished [1]) three variations, *angusta*, *lata* and *convexa*. The first of these forms has been figured by d'Orbigny [2]) under the name of "var. *B*", while *lata* was indicated by this author as "var. *A*".

According to Boas, *angusta* occurs in the North Atlantic (60°—40° N.B.) and in the east part of the Pacific, while *lata* is found in the Atlantic (40° N.B.—30° S.B.), Mediterranean, Indian Ocean, China Sea and in the west part of the Pacific. I cannot, however, attach any importance to this geographical distribution, as in the Siboga-material the two forms *angusta* and *lata* occurred together (*angusta:* stat. 59, 102, 139, 177[a], 185, 203, 211, 276; *lata:* stat. 52, 88, 141, 178, 211, 212, 243).

The variety *convexa* (southern part of the Indian Ocean and South-Atlantic, according to Boas) exhibits such a slight difference from *lata*, that to my opinion it must be referred to this form (cf. the series of figures, given by Boas, l. c.). The only difference which holds good, is the smaller size of *convexa*. The Siboga Expedition has not found it.

7. *Clio cuspidata* (Bosc).

1802. *Hyalaea cuspidata* Bosc, Histoire naturelle des Coquilles, vol. II, p. 238 (241?), pl. IX, figs. 5—7.
1820. *Hyalaea tricuspidata* Bowdich, Elements of Conchology, pl. VI, fig. 1.
1830. *Cleodora lessonii* Rang, MS., in: Lesson, Voyage autour du Monde de la Coquille, vol. II, prt. 1, p. 247, pl. X, fig. 1.
1833. *Cleodora cuspidata* Qoy et Gaimard, Voyage de l'Astrolabe, Zoologie, vol. II, p. 384, pl. XXVII, figs. 1—5.
1852. ? *Cleodora quadrispinosa* [3]) Rang, Histoire naturelle des Mollusques Ptéropodes. pl. V, fig. 6.
1888. *Clio cuspidata* Pelseneer, Chall. Rep., LXV, p. 66.

Empty shells:
Stat. 95. 5° 43′.5 N., 119° 40′ E. 1 spec.
Stat. 118. 1° 38′ N., 124° 28′.2 E. 1 spec.
Stat. 211. 5° 40′.7 S., 120° 45′.5 E. 2 spec.

This species, found abundantly by Lesson (see the note) on the West coast of Australia, has been recorded by the Siboga Expedition from a few stations only. It was moreover only represented by empty shells.

The figure given by Woodward [4]) does not represent, as this author says, "*Cleodora*" *pyramidata*, but *Clio cuspidata*.

Anatomical Remarks.

The anatomy of the genus *Clio* has been studied several times, and after the publications

1) Spolia atlantica, p. 70—73, pl. 6, figs. 96—97.
2) Voyage dans l'Amérique méridionale, vol. V, pl. VII, figs. 25—32.
3) This species, already referred to by Lesson (Voyage de la Coquille, vol. II, prt. 1, p. 248), is probably the same as *Clio cuspidata*, though this suggestion cannot be made with absolute confidence. According to Lesson, the shell "présente quatre angles et par conséquent quatre faces, qui distants à leur base et très ouverts, finissent en une point aiguë et un peu contournée", while the fins of the animal are "soudés en avant par un petit lobule arrondi".
4) A Manual of the Mollusca, pl. XIV, fig. 33 (2d Ed.).

of P. J. VAN BENEDEN[1]), SOULEYET[2]), GEGENBAUR[3]), BOAS[4]) and PELSENEER[5]), it seems to me of no use to discuss the anatomy fully, as the various researches, which complete each other, have been already sufficiently treated by PELSENEER, who at the same time demonstrated the phylogenetic affinities of the subgenera.

Creseis shows much resemblance with *Limacina* and is the most primitive subgenus of *Clio*. This is not only shown by the tentacular lobe on the fin, with which also some species of *Limacina* are provided, but also by the tentacles, the left of which is very small and scarcely visible, which agrees with the one that is found in *Limacina*. The left tentacle is somewhat larger in *Hyalocylix*, *Styliola* and *Clio (s. str.)* but even in this last subgenus it does not nearly attain the dimensions of the right one. I must observe, however, that I could only study two species of *Clio (s. str.)*, so that my researches are not complete in this respect. *Clio pyramidata* and *Clio cuspidata* (Leyden Museum) were only at my disposal. In this two species I remarked between the tentacles a triangular lobe, directed forward; it has been already noted by SOULEYET.

As to the foot, the fins, the mantle and the pallial gland, I entirely refer to PELSENEER. Also with regard to the jaws, the radula, and the salivary glands.

In all the species of the genus *Clio*, examined by me, I found a caecum, entirely concealed in the liver, and opening at the right side of the stomach. In *Clio (s. str.)* it is somewhat swollen at the end. In *Clio cuspidata* I noticed a curious, bell-shaped organ, strongly attached to the intestine. Muscular fibres were seen on this bell, and, comparable with a clapper, a dark, rounded organ was found within. The bad preservation of the specimens did not allow me to study the structure of this organ; most probably it is glandular and opens into the intestine (Pl. I, fig. 18).

About the flexure of the intestine, the position of the anus in the various subgenera, and the anal gland, I have nothing to remark. GEGENBAUR's figure[6]) which represents the intestine of *Clio (Creseis) acicula* as curved dorsally, has been reproduced in several works, but the inaccuracies as to the organisation of this species were carried to the extreme by HALLER[7]), whose figure is wrong in almost every respect. HORNELL's paper[8]), treating on *Clio (Creseis) acicula*, I could unfortunately not study.

The various dispositions of the heart and kidney have been described by BOAS[9]); I, therefore, refer to his work. Gills are entirely wanting.

The gonad is situated posteriorly; in *Clio cuspidata*, however, I have always found it dorsally to the liver, and somewhat to the right. The duct exhibits an elongated swelling, but its shape varies in the same species, the swelling being more or less pronounced and sometimes divided into two parts, which is due in all probability to the maturation of the sexual products.

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1) Exercices zoötomiques, Mem. Acad. Sci. Brux. vol. XII, 1839.
2) Voyage de la Bonite, Zoölogie, vol. II, p. 164—175.
3) Unters. üb. Pterop. u. Heterop., Leipzig, 1885.
4) Spolia atlantica, p. 54—57.
5) Chall. Rep. LXVI, p. 13—16.
6) Unters. üb. Pterop. u. Heterop., pl. II, fig. 1.
7) Lehrb. vergl. Anat. p. 261, 1902.
8) Anatomical Description of *Creseis*, as a typical Pteropod, Marine Zool., vol. II, (1895), p. 19—24.
9) Spolia atlantica, p. 28—30.

To such a temporal enlargement of the efferent duct one must refer, to my opinion, the "appendice coecal" of SOULEYET [1]). Once I too found in this species something of the kind. Like PELSENEER, I did not find in *Clio (Creseis) acicula* the receptaculum seminis, figured by GEGENBAUR [2]); I noticed, however, at the "Uterusdrüse" an organ in a similar disposition, as the receptaculum seminis displays in the other species (Pl. I, fig. 19).

In *Styliola* this receptaculum seminis is more slender (Pl. I, fig. 20), while it is rounded in *Hyalocylix* and *Clio (s. str.)*. The accessory genital glands are generally very much hardened in spirit-specimens.

The central nervous system has been accurately described by PELSENEER [3]), and I agree with him in almost every respect. The cerebral and pedal ganglia are symmetrical as in *Limacina*, but this is not the case with the visceral ganglia, the left portion being larger than the right one. According to PELSENEER, this asymmetry is "particularly prominent" in *Creseis*; I found it, however, scarcely indicated in *Clio (Creseis) acicula* (Pl. II, fig. 21). In this species, as in *Clio pyramidata*, particularly examined in this respect, I noticed a small second pedal commissure. (Pl. II, figs. 21—22).

I have seen only one tentacular nerve (Pl. II, fig. 22), but I have no doubt, that two of them really exist, as in *Limacina*. I shall not remark anything about other nerves, issuing from the ganglia; they are shown in the figures.

The buccal ganglia are united by a rather strong commissure to the cerebral ganglia (Pl. II, fig. 23) und form a single mass.

Cuvierina Boas.

1824. *Cleodora (part.)* Qoy et Gaimard, Voyage de l'Uranie, Zoologie, p. 145.
1824. *Triptera* Auctorum.
1827. *Cuvieria* Rang, Description de deux genres nouveaux appartenant à la classe des Ptéropodes, Ann. d. Sc. Nat., sér. 1, vol. XII, p. 322.
1886. *Cuvierina* Boas, Spolia atlantica, Bidrag til Pteropodernes Morfologi, etc. p. 131.

1. *Cuvierina columnella* (Rang).

1824. *Cleodora obtusa* Qoy et Gaimard, Voyage de l'Uranie, Zoologie, p. 145, pl. LXVI, fig. 5.
1827. *Cuvieria columnella* Rang, Description de deux genres nouveaux, etc., Ann. d. Sc. Nat., sér. 1, vol. XII, p. 323, pl. XLV, figs. 1—8.
1835. *Cuvieria oryza* Benson, Corrected characters of the genus *Cuvieria*, and Notice of a second species inhabiting the tropical Indian Ocean, Journ. Asiat. Soc. Bengal, vol. IV, p. 698.
1839. *Cuvieria obtusa* d'Orbigny, Hist. nat. des Canaries, Moll., p. 32.
1850. *Triptera columnella* Gray, Catalogue of the Mollusca in the Collection of the British Museum, prt. II, Pteropoda, p. 23.
1850. *Cuvieria urceolaris* Mørch, Catalogus conchyliorum quae reliquit C. P. KJERULF, Hafniae, p. 32.

1) Voyage de la Bonite, vol. II, p. 171, note 1, pl. XI, fig. 7, *z* and *z'*.
2) Op. s. c. pl. II, fig. 3.
3) Op. s. c. p. 15—16.

1879. *Triptera columnella, cancellata* Pfeffer, Uebersicht der auf S. M. Schiff "Gazelle" und von Dr. JAGOR gesammelten Pteropoden, Monatsber. d. k. preuss. Akad. d. Wissensch. Berlin, 1879, p. 243, figs. 18—19.

1886. *Cuvierina columnella* Boas, Spolia atlantica, Bidrag til Pteropodernes Morfologie, etc., p. 132, pl. 3, fig. 39; pl. 6, fig. 95; pl. 4, fig. 56.

Empty shells:

Stat. 59.	10° 22'.7 S.,	123° 16'.5 E.	1 spec.
Stat. 88.	0° 34'.6 N.,	119° 8'.5 E.	1 spec.
Stat. 95.	5° 43'.5 N.,	119° 40' E.	1 spec.
Stat. 100.	6° 11' N.,	120° 37'.5 E.	1 spec.
Stat. 102.	6° 4'.1 N.,	120° 44' E.	5 spec.
Stat. 157.	0° 32'.9 S.,	130° 14'.6 E.	1 spec.
Stat. 178.	2° 40' S.,	128° 37'.5 E.	3 spec.
Stat. 208.	5° 39' S.,	122° 12' E.	2 spec.
Stat. 211.	5° 40'.7 S.,	120° 45' E.	2 spec.
Stat. 241.	4° 24'.3 S.,	129° 49'.3 E.	11 spec.
Stat. 300.	10° 48'.6 S.,	123° 23'.1 E.	1 spec.

The only known species of this genus has been recorded from three stations. Only empty shells have been found.

BOAS (see the list of synonyms), who changed the generic name *Cuvieria* Rang, into *Cuvierina*, as the title *Cuvieria* was already given to other animals before 1827, distinguished two varieties.

One of them, the var. *typica*, already known to the discoverer of the species, is elongated, and the constriction behind the aperture is more marked than in the second form. This is var. *urceolaris*, which was regarded by MØRCH (see above) as a distinct species, as PFEFFER has done too (*Triptera cancellata*, see above). This variety is shorter and more bulging. These two forms, however, are linked by gradual transitions. According to BOAS, *typica* occurs in the Atlantic, in the Indian Ocean, and East-Pacific, while *urceolaris* is found in the China Sea and the West-Pacific. It was to be expected, that the two varieties should occur together in the Indian Archipelago. The Siboga-specimens must be referred to *urceolaris*, but other specimens (with the animals in the shells) from Sunda Strait (Utrecht Zoological Museum) belong partly to *urceolaris*, partly to *typica*.

Remarks upon Anatomy.

I could only study a few specimens from the Utrecht Zoological Museum, two of which I have sacrificed for anatomical purposes. The same authors who studied the anatomy of *Clio*, have also occupied themselves with the investigation of *Cuvierina*.

I could state that *Cuvierina* shows great resemblance with the subgenera *Styliola* and *Clio (s. str.)*. The left tentacle, however, though situated on the same transverse line with the right, is much less developed, and very small. The fins agree with those of *Clio (s. str.)*, but the posterior lobe of the foot is notched in the middle of its free margin; this was already stated by SOULEYET [1]) and by PELSENEER [2]), but the figure of this last author does not show it sufficiently.

1) Voyage de la Bonite, Zoölogie, vol. II, p. 199, pl. XII, figs. 1—3.
2) Chall. Rep. LXVI, p. 16, pl. II, fig. 6.

The mantle has a balancer on the left side [1]), which occurs in all Cavoliniidae. But also on the right side a lobe of nearly the same size may be seen.

As to the pallial gland, the jaws, the radula, and the salivary glands, I have nothing to add to what has been published by SOULEYET, BOAS and PELSENEER.

I have noticed a gastric coecum, as in all Cavoliniidae; it has not been observed by PELSENEER. For further information I can refer to this author. Also with regard to the disposition and form of the heart and kidney.

The gonad occupies the posterior portion of the visceral mass, as in *Clio pyramidata*. From its dorsal side issues an efferent duct, which exhibits the same elongated swelling as in *Clio*. I could not clearly perceive a receptaculum seminis at the accessory genital glands (Pl. II, fig. 25). Rang already described and figured [2]) (though very inaccurately) a curious appendage, which he took for a gill; several zoologists after him regarded it as the penis. Most probably it is an accessory copulatory organ, as SOULEYET [3]) and PELSENEER [4]) suspected. I have also found it in one case (Pl. II, fig. 24). The left branch, which terminates in a point, exhibits at its base a thick gland (?), already mentioned by SOULEYET.

The penis is remarkable through the fact, that the horny stylet is slender, and is situated in a pouch at the extremity of the copulatory organ.

The central nervous system is like that of *Clio*. PELSENEER [5]) affirms that the pleural ganglia "are here recognisable externally"; I owe, that I could not distinguish them clearly from the cerebral or pedal ganglia. The difference between the two halves of the visceral ganglionic mass is more pronounced than in *Clio*. The second pedal commissure which I have noticed, was somewhat longer than in PELSENEER's figure [6]). Two nerves proceed from the anterior part of the cerebral ganglia (Pl. II, fig. 26 *B*). I have seen several nerves issuing from the pedal ganglia and supplying the fins. From the front of the pedal ganglia rises a nerve, which, as we shall see further on, also exists in *Cymbulia*. In this case, in *Cuvierina*, I have only seen the nerve of the right ganglion, but most probably there is another on the left (Pl. II, fig. 26 *A*, 7).

The distribution of the pallial and visceral nerves is the same as in *Clio*, but according to my observations, the origins of the three nerves, issuing from the left ganglionic mass are not so near one another as is shown in PELSENEER's figure [6]) (Pl. II, fig. 26 *A*, 3, 5, 6).

The buccal ganglia form a single mass; the commissures to the cerebral ganglia, and the nerves issuing from the approximated ganglia, are the same as in *Clio*.

Cavolinia [7]) Abildgaard.

1791. *Cavolina* Abildgaard, Om Cavolina natans, Anomia tridentata Forskalaei, Skriv. Naturhist. Selsk., Bd. 1, Heft II, p. 173.

1792. *Cavolinia* Bruguière, Encyclopédie Methodique; Historie naturelle des Vers, vol. I.

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1) Not on the right side, as PELSENEER states, apparently by a slip of the pen (op. s. c., p. 16).

2) Hist. nat. des Mollusques Ptéropodes, pl. IV, figs. 10—11. 3) Voyage de la Bonite, vol. II, p. 201.

4) Op. s. c. p. 17. 5) Chall. Rep. LXVI, p. 17. 6) Op. s. cit., pl. III, fig. 1.

7) To the list of generic names, given here, must be added, to my opinion: *Anomia* Forskål (Faune arabique, p. 124, 1775) and *Gioënia* Gioëni (Descrizione di una nuova Famiglia e di un nuovo Genere ni Testacei trovati nel littorali di Catania, Napoli, 1783).

1797. *Rheda* Humphreys, Museum Calonnianum.
1801. *Hyalaea* Lamarck, Système des anim. sans vertèbres, p. 139.
1810. *Archonta* Denis de Montfort, Conchyliologie Systematique, vol. II, p. 50.
1815. *Tricla* Oken, Lehrbuch der Zoologie, vol. I, p. 327.
1825. *Pleuropus* Eschscholtz, Bericht über die Zoologische Ausbeute während der Reise von Cronstadt bis St.-Peter und Paul, Oken, Isis, Bd. I, p. 735.
1842. *Diacria* Gray, Synopsis of the contents of the British Museum.
1859. *Orbignyia* A. Adams, On synonyms and habitats of *Cavolinia*, *Diacria* and *Pleuropus*, Ann. and Mag. Nat. Hist., ser. III, vol. 3, p. 45.

Subgenus *Diacria* Gray.

Hyalaea (part.) Auctorum.
Pleuropus (part.) Auctorum.
1850. *Diacria (part.)* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 10.
1886. *Hyalaea, A.* Boas, Spolia atlantica, Bidrag, etc., p. 91.
1888. *Diacria* Pelseneer, Chall. Rep. LXVI, p. 21.

1. *Cavolinia (Diacria) trispinosa* (Lesueur).

1821. *Hyalaea trispinosa* Lesueur, in: DE BLAINVILLE, Dict. d. Sci. Nat., vol. XXII, p. 82.
1827. *Hyalaea mucronata* Quoy et Gaimard, Observations zoölogiques faites à bord de l'Astrolabe, etc., Ann. d. Sci. Nat., sér. 1, vol. X, p. 231, pl. VII *B*, figs. 1—2.
1832. *Hyalaea depressa* Bivona, Descrizione di una nuova specie di Jale, etc., Efemeride scientifiche e litterarie per la Sicilia, p. 57, pl. I, figs. 4—5.
1841. *Hyalaea cuspidata* Delle Chiaje, Descrizione e notomia degli animali senza vertebre del Regno di Napoli, pl. CLXXX, figs. 1—2.
1850. *Diacria trispinosa* Gray, Catal. of the Moll. in the Coll. British Museum, prt. II, Pteropoda, p. 10.
1850. *Diacria mucronata* Gray, Ibid., p. 11.
1853. *Hyalaea reeviana* Dunker, Index Molluscorum, etc., p. 2, pl. I, figs. 17—20.
1858. *Pleuropus trispinosus* A. and H. Adams, The Genera of recent Mollusca, vol. II, p. 611.
1858. *Pleuropus mucronatus* A. and H. Adams. Ibid.
1879. *Pleuropus trispinosa* Pfeffer, Uebersicht der auf S. M. Schiff "Gazelle", etc., Monatsber. Berl. Akad., 1879, p. 236, fig. 6.
1886. *Cavolinia trispinosa* Locard, Prodrome de conchyliologie française, p. 22.
1889. *Cavolinia (Diacria) trispinosa* Dall, in Bullet. U. S. Nat. Museum, XXXVII, p. 82, pl. LXVI, fig. 115.

Empty shells:

Stat. 59. 10° 22′.7 S., 123° 16′.5 E. 2 spec.
Stat. 88. 0° 34′.6 N., 119° 8′.5 E. 2 spec.
Stat. 95. 5° 43′.5 N., 119° 40′ E. 4 spec.
Stat. 100. 6° 11′ N., 120° 37′.5 E. 1 spec.
Stat. 102. 6° 4′.1 N., 120° 44′ E. 4 spec.
Stat. 211. 5° 40′.7 S., 120° 45′.5 E. 2 spec.
Stat. 221. 6° 24′ S., 124° 39′ E. 5 spec.
Stat. 300. 10° 48′.6 S., 123° 23′.1 E. 1 spec.

The first name cannot be used, as the title *Anomia* had been already given to quite other animals; the name *Gioënia* never occurs again. I have unfortunately not been able to see the paper of GIOËNI, and I can only mention the title on the authority of DE BLAINVILLE (Dict. d. Sci. Nat. vol. XXII, p. 65, note) and SOULEYET (Hist. nat. Ptérop. p. 33, note 1). But if really GIOËNI has used this title, it has the priority over *Cavolina*.

It may be remarked that not a single living animal was obtained by the expedition; nothing but empty shells have been found. This seems the more striking, since this species, according to BOAS [1]) and several other authors, is very abundant in the warm seas.

Hyalaea mucronata, very obscurely described by QUOY and GAIMARD (see the synonyms) has been regarded as a distinct species by D'ORBIGNY [2]). It must be noted, however, that the type of QUOY and GAIMARD, did not differ from that of LESUEUR, while D'ORBIGNY, who found a somewhat different form, regarded it as the type, described by the zoologists of the Astrolabe. The "species" of D'ORBIGNY is somewhat larger, more flattened, and the lateral points are less divergent and more directed backwards than in *Hyalaea trispinosa* Lesueur. BOAS [3]) described two varieties: *minor*, corresponding to the form of LESUEUR, and *major*, agreeing with *Hyalaea mucronata* d'Orbigny. As to the differences between these forms, I must refer to BOAS's important paper. But I have felt the truth there is in his words, that it is in some cases impossible to decide, whether a specimen must be referred to *major* or to *minor*. Neither the extension of the brown colour, nor the distinctness of dorsal grooves are differences which hold good. Besides, the two varieties are not at all local; they occur together in the Atlantic and in the Indian Ocean [4]).

I have referred to *major* the specimens of stat.: 59, 88, 95, 100, 102; to *minor* those of stat.: 88, 211, 221, 300.

In nearly all the specimens of *major* the long terminal point was broken off. According to BOAS, this point is proportionally shorter than in *minor*.

To show the different forms, I have figured some shells, seen from the dorsal side (Pl. II, figs. 27—31).

2. *Cavolinia (Diacria) quadridentata* [5]) (Lesueur).

1821. *Hyalaea quadridentata* Lesueur in: DE BLAINVILLE, Dict. d. Sci. Nat. vol. XXII, p. 81.
1850. *Cavolina quadridentata* Gray, Catalogue of the Mollusca in the Collection of the British Museum, prt. II, Pteropoda, p. 8.
1852. *Hyalaea inermis* Gould, The Mollusca and Shells of the U. S. Exploring Expedition under the command of WILKES, pl. LI, fig. 604.
1877. *Hyalaea minuta* Sowerby, in Reeve, Conchologica iconica, vol. XX, Pteropoda, fig. 9.
1877. *Hyalaea intermedia* Sowerby, Ibid., fig. 10.
1879. *Hyalaea costata* Pfeffer, Uebersicht der auf S. M. Schiff "Gazelle" und von Dr. JAGOR gesammelten Pteropoden, Monatsber. d. k. preuss. Akad. Wissensch. Berlin, 1879. p. 234.
1888. *Cavolinia quadridentata* Pelseneer, Chall. Rep. LXV, p. 78.

Living animals:

Stat. 1. 7° 27'.5 S., 113° 8'.5 E. 1 spec.
Stat. 36. 7° 38' S., 117° 31' E. 2 spec.
Stat. 37. Sailus ketjil, Paternoster Islands. 7 spec.

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1) Spolia atlantica, p. 95.
2) Voyage dans l'Amérique méridionale, vol. V, p. 108, pl. VII, figs. 6—10.
3) L. c. s.
4) Op. s. c., p. 96.
5) D'ORBIGNY (Voyage d. l'Amér. mérid. vol. V, p. 107) when speaking about *Hyalaea trispinosa*, which he compares with his *Hyalaea quadridentata* (p. 98), gives the name *quadrispinosa* erroneously to this last species. This must be simply a mistake, and I cannot admit this name into the list of synonyms.

Stat. 66.	South of Saleyer.	3 spec.
Stat. 89.	Pulu Kaniungan ketjil.	1 spec.
Stat. 99.	6° 7'.5 N., 120° 26' E.	1 spec.
Stat. 106.	Kapul Island, Sulu Archipelago.	12 spec.
Stat. 136.	Ternate.	3 spec.
Stat. 138.	East coast of Kajoa Island.	8 spec.
Stat. 143.	1° 4'.5 S., 127° 52'.6 E.	4 spec.
Stat. 144.	Damar Island.	5 spec.
Stat. 148.	0° 17'.6 S., 129° 14'.5 E.	3 spec.
Stat. 157.	0° 32'.9 S., 130° 14'.6 E.	1 spec.
Stat. 165.	Daram Island.	4 spec.
Stat. 169.	Atjatuning, West coast of New-Guinea.	3 spec.
Stat. 177a.	2° 30' S., 129° 28' E.	8 spec.
Stat. 178.	2° 40' S., 128° 37'.5 E.	1 spec.
Stat. 185.	3° 20' S., 127° 22'.9 E.	10 spec.
Stat. 203.	3° 32'.5 S., 124° 15'.5 E.	1 spec.
Stat. 215a.	Kabia Island.	2 spec.
Stat. 224.	5° 34' S., 127° 4' E.	1 spec.
Stat. 243.	4° 30'.2 S., 129° 25' E.	8 spec.
Stat. 276.	6° 47'.5 S., 128° 40'.5 E.	1 spec.
Stat. 303.	Haingsisi, Samau Island.	1 spec.
Stat. 315.	Sailus Besar, Paternoster Islands.	1 spec.

Empty shells:

Stat. 59.	10° 22'.7 S., 123° 16'.5 E.	2 spec.
Stat. 95.	5° 43'.5 N., 112° 40' E.	1 spec.
Stat. 139.	0° 11' S., 127° 25' E.	3 spec.
Stat. 165.	Daram Island.	1 spec.
Stat. 177a.	2° 30' S., 129° 28' E.	4 spec.

This species is a very common form in the whole East-Indian Archipelago. In all the specimens the dorsal ribs on the shell are very strong; they all belong to the form *costata* Pfeffer (see above), which occurs abundantly in the Red Sea and the Indian Ocean. It is only a variety of the type (Boas) [1]).

Subgenus *Cavolinia (s. str.)* Pelseneer.

Hyalaea (part.) Auctorum.
Pleuropus (part.) Auctorum.
1850. *Diacria (part.)* Gray, Catalogue of the Mollusca in the Collection of the British Museum, prt. II, Pteropoda, p. 10.
1886. *Hyalaea, B* Boas, Spolia atlantica, Bidrag til Pteropodernes Morfologi, etc., p. 92.
1888. *Cavolinia (s. str.)* Pelseneer, Challenger Rep. LXVI, p. 20.

3. *Cavolinia tridentata* (Forskål).

1767. ? *Monoculus telemus* Linné, Systema Naturae, 12th Ed., vol. 1, prt. II, p. 1059.
1773. *Anomia tridentata* Forskål, Descriptiones animalium quae in itinere orientali observavit, p. 124.
1783. *Gioënia* sp. ? Gioëni (*fide* Souleyet), Descrizione di una nuova Famiglia e di un nuovo Genere di Testacei trovati nel littorali di Catania.

1) Spolia atlantica, p. 100.

1791. *Cavolina natans* Abildgaard, Nyere Efterretning om det Skaldyr som Forskål har beskrevet under Navnet *Anomia tridentata*, Skriv. Naturh. Selsk, Bd. I, Heft 2, p. 175, pl. X.
1801. *Hyalaea cornea* Lamarck, Système des anim. sans vert. p. 140.
1802. *Hyalaea tridentata* Bosc, Hist. nat. des coq., vol. II, pl. X, fig. 4.
1804. *Hyalaea papilionacea* Bory de Saint-Vincent, Voyage dans les quatres principales îles des mers d'Afrique, vol. I, p. 137, pl. V, fig. 1.
1810. *Hyale téniobranche* Péron et Lesueur, Histoire de la famille des Mollusques Ptéropodes, Ann. Mus. Hist. Nat. Paris, vol. XV, pl. II, fig. 13.
1813. *Hyalaea peronii* Lesueur, Mémoire sur quelques animaux Mollusques, etc., Nouv. Bullet. Soc. Philom., vol. III, p. 284.
1813. *Hyalaea chemnitziana* Lesueur, Ibid, p. 284.
1816. *Hyalaea australis* Péron, Voyage de découvertes aux terres australes, vol. I, pl. XXXI, fig. 5.
1821. *Hyalaea forskalii* Lesueur in: DE BLAINVILLE, Dict. d. Sci. Nat., vol. XXII, p. 79.
1821. *Hyalaea teniobranchia* de Blainville, Ibid., p. 80.
1836. *Hyalaea affinis* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 91, pl. V, figs. 6—10.
1848. *Hyalaea truncata* Krauss, Südafrikanische Mollusken, p. 34, pl. II, fig. 12.
1859. *Cavolina telemus* A. Adams, On the Synonyms and Habitats of *Cavolinia*, *Diacria* and *Pleuropus*, Ann. and Mag. Nat. Hist., ser. III, vol. 3, p. 44.
1877. *Cavolinia cumingii* Sowerby in: REEVE, Conchologica iconica, vol. XX, Pteropoda, pl. I, fig. 5.
1882. *Cavolina tridentata* Verrill, Catalogue of marine Mollusca added to the Fauna of New England during the past ten years, Transact. Conn. Acad. vol. V, prt. 2, p. 554, figs. 6—7.
1882. *Cavolinia tridentata* Fischer, Manuel de Conchyliologie, p. 434.

Living animals;

Stat. 110. 4° 34′ N., 122° 0′ E. 1 spec.
Stat. 276. 6° 47′.5 S., 128° 40′.5 E. 1 spec.

Empty shells:

Stat. 45. 7° 24′ S., 118° 15′.2 E. 1 spec.
Stat. 52. 9° 3′.4 S., 119° 56′.7 E. 7 spec.
Stat. 88. 0° 34′.6 N., 119° 8′.5 E. 3 spec.
Stat. 95. 5° 43′.5 N., 119° 40′ E. 3 spec.
Stat. 100. 6° 11′ N., 120° 37′.5 E. 2 spec.
Stat. 116. 0° 58′.5 N., 122° 42′.5 E. 1 spec.
Stat. 178. 2° 40′ S., 128° 37′.5 E. 3 spec.
Stat. 208. 5° 39′ S., 122° 12′ E. 1 spec.
Stat. 211. 5° 40′.7 S., 120° 45′.5 E. 5 spec.
Stat. 221. 6° 24′ S., 124° 39′ E. 4 spec.
Stat. 240. Banda. 1 spec.

Cavolinia tridentata occurs in the East-Indian Archipelago, but it is not so abundant as nearly all the other species of *Cavolinia (s. str.)*.

BOAS [1]) distinguished already two varieties which, however, are linked to the type by gradual transitions. One of these varieties, the *Hyalaea affinis* of D'ORBIGNY was found at station 116. It is an extreme form and, at first sight, it may be regarded as a *Cavolinia uncinata*, with which *Cavolinia tridentata* is closely allied, but it is distinguished from this species by the less pronounced dorsal ribs, by the oblique direction of the dorsal lip, the slight

1) Spolia atlantica, p. 116—117. See his table 6, fig. 100.

divergence of the lateral margins, and the direction of the terminal point, which does not exhibit the strong curvature of *Cavolinia uncinata* at all, but is almost straight (Pl. II, figs. 32—33). The variety *affinis* in its most extreme forms, had been recorded already from the East-Pacific Ocean (Boas, Spolia atlantica, p. 116).

The variety *truncata* of this author (South-Atlantic and western part of Indian Ocean) was not found among the Siboga-specimens.

4. *Cavolinia uncinata* (Rang).

1836. *Hyalaea uncinata* Rang, in: d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 93, pl. V, figs. 11—15.
1850. *Cavolina uncinata* Gray, Catalogue of the Mollusca in the Collection of the British Museum, prt. II, Pteropoda, p. 7.
1880. *Hyalaea uncinatiformis* Pfeffer, Die Pteropoden des Hamburger Museums, Abh. aus d. Geb. d. Naturw. herausg. vom Naturw. Ver. Hamburg, Bd. VII, p. 83.
1888. *Cavolinia uncinata* Pelseneer, Chall. Rep. LXV, p. 84.

Living animals:

Stat. 117a. 1° 15′ N., 123° 37′ E. 3 spec.
Stat. 303. Haingsisi, Samau Island. 1 spec.

Empty shells:

Stat. 45. 7° 24′ S., 118° 15′.2 E. 1 spec.
Stat. 52. 9° 3′.4 S., 119° 56′.7 E. 10 spec.
Stat. 59. 10° 22′.7 S., 123° 16′.5 E. 2 spec.
Stat. 65a. 7° 0′ S., 120° 34′.5 E. 2 spec.
Stat. 88. 0° 34′.6 N., 119° 8′.5 E. 31 spec.
Stat. 90. 1° 17′.5 N., 118° 53′ E. 1 spec.
Stat. 95. 5° 43′.5 N., 119° 40′ E. 15 spec.
Stat. 102. 6° 4′.1 N., 120° 44′ E. 14 spec.
Stat. 105. 6° 8′ N., 121° 19′ E. 1 spec.
Stat. 117a. 1° 15′ N., 123° 37′ E. 1 spec.
Stat. 136. Ternate. 1 spec.
Stat. 137. 0° 23′.8 N., 127° 29′ E. 7 spec.
Stat. 139. 0° 11′ S., 127° 25′ E. 2 spec.
Stat. 151. 0° 12′.6 S., 129° 48′ E. 4 spec.
Stat. 159. 0° 59′.1 S., 129° 48′.8 E. 17 spec.
Stat. 178. 2° 40′ S., 128° 37′.5 E. 32 spec.
Stat. 208. 5° 39′ S., 122° 12′ E. 9 spec.
Stat. 212. 5° 54′.5 S., 120° 19′.2 E. 8 spec.
Stat. 221. 6° 24′ S., 124° 39′ E. 2 spec.
Stat. 267. 5° 54′ S., 132° 56′.7 E. 1 spec.
Stat. 300. 10° 48′.6 S., 123° 23′.1 E. 2 spec.
Stat. 312. 8° 19′ S., 117° 41′ E. 1 spec.

Cavolinia uncinata, chiefly represented by empty shells, is a very common form.

Some specimens are remarkably hyaline, but in the sculpture of the shell, the curvature of the posterior point, as well as in the direction and size of the lateral spines, all the specimens are very much alike.

5. *Cavolinia gibbosa* (Rang).

1836. *Hyalaea gibbosa* Rang in: D'ORBIGNY, Voyage dans l'Amérique méridionale, vol. V, p. 95, pl. V, figs. 16—20.
1836. *Hyalaea flava* d'Orbigny, Ibid., p. 97, pl. V, figs. 21—25.
1850. *Cavolina gibbosa* Gray, Catalogue of the Mollusca in the Collection of the British Museum, prt. II, Pteropoda, p. 8.
1850. *Cavolina flava* Gray, Ibid., p. 8.
1880. *Hyalaea gegenbauri* Pfeffer, Die Pteropoden des Hamburger Museums, Abh. Naturw. Ver. Hamb. Bd. VII, p. 86, figs. 7—7*a*.
1886. *Cavolinia gibbosa* Locard, Prodrome conchyliologie française, p. 22.

Empty shells:

Stat. 45.	7° 24′ S.,	118° 15′.2 E.	2 spec.
Stat. 52.	9° 3′.4 S.,	119° 56′.7 E.	11 spec.
Stat. 59.	10° 22′.7 S.,	123° 16′.5 E.	3 spec.
Stat. 65a.	7° 0′ S.,	120° 34′.5 E.	1 spec.
Stat. 88.	0° 34′.6 N.,	119° 8′.5 E.	16 spec.
Stat. 95.	5° 43′.5 N.,	119° 40′ E.	7 spec.
Stat. 98.	6° 9′ N.,	120° 21′ E.	1 spec.
Stat. 100.	6° 11′ N.,	120° 37′.5 E.	2 spec.
Stat. 102.	6° 4′.1 N.,	120° 44′ E.	6 spec.
Stat. 178.	2° 40′ S.,	128° 37′.5 E.	1 spec.
Stat. 208.	5° 39′ S.,	122° 12′ E.	6 spec.
Stat. 210a.	5° 26′ S.,	121° 18′ E.	1 spec.
Stat. 211.	5° 40′.7 S.,	120° 45′.5 E.	4 spec.
Stat. 212.	5° 54′.5 S.,	120° 19′.2 E.	4 spec.
Stat. 221.	6° 24′ S.,	124° 39′ E.	2 spec.
Stat. 300.	10° 48′.6 S.,	123° 23′.1 E.	1 spec.

Only empty shells of this species have been found. I think that living animals rarely occur in the tropics (see D'ORBIGNY [1]), BOAS [2]), PELSENEER [3]), MUNTHE [4]), at least in the neighbourhood of the equator.

Several authors, among them SOULEYET [5]) and BENSON [6]), have deplorably confused the forms *Hyalaea gibbosa* Rang (= *Hyalaea flava* d'Orbigny) and *Hyalaea gibbosa* d'Orbigny (= *Hyalaea gegenbauri* Pfeffer). PFEFFER [7]) has given an account of the different interpretations.

The Siboga-specimens agree in many points with the form *flava* d'Orbigny. Very probably, however, gradual transitions may be found to *gibbosa* d'Orbigny, and I can scarcely attach any importance to the maintaining of the differences between these forms.

BOAS [8]) described a variety from the Indian Ocean; I have seen specimens from this region (32° S., 31° E.) from the Leyden Museum, which agree with his figure, but the variety was not found in the collection of the Siboga.

1) Voyage d. l'Amér. mér. vol. V, p. 96.
2) Spolia atl. p. 111.
3) Chall. Rēp. LXV, p. 82—83.
3) Pterop. i Ups. Un. Zool. Mus., Bih. t. K. Svenska vet-akad. Handl., Bd. 13, afd. IV, n⁰ 2, p. 25.
5) Voyage de la Bonite, vol. II, p. 145.
6) Ann. and. Mag. Nat. Hist., ser. III, 7, p. 23—24.
7) Abh. Naturw. Ver. Hamb., p. 87.
8) L. s. c., pl. 6, fig. 99*a*.

From this collection I mention a single shell (Stat. 102) which exhibits some variations (Pl. II, figs. 34—35). It is much more flattened than any other specimen; the transverse grooves on the ventral side are less distinct, and the terminal point is almost straight.

6. *Cavolinia globulosa* (Rang).

1850. *Cavolina globulosa* Rang, in: GRAY, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 8.
1850. *Cavolina pisum* Mørch, Catalogus conchyliorum quae reliquit KJERULF, p. 32, pl. I, fig. 7.
1852. *Hyalaea globulosa* Rang, in: SOULEYET, Voyage de la Bonite, vol. II, p. 142, pl. IV, figs. 20—24.
1888. *Cavolinia globulosa* Pelseneer, Chall. Rep., LXV, p. 81.

Living animals:

Stat. 96.	Pearl-bank, Sulu Archipelago.	1 spec.
Stat. 143.	1° 4'.5 S., 127° 52'.6 E.	1 spec.
Stat. 144.	Damar Island.	1 spec.
Stat. 177[a].	2° 30' S., 129° 28' E.	1 spec.

Empty shells:

Stat. 52.	9° 3'.4 S., 119° 56'.7 E.	4 spec.
Stat. 59.	10° 22'.7 S., 123° 16'.5 E.	1 spec.
Stat. 65[a].	7° 0' S., 120° 34'.5 E.	1 spec.
Stat. 88.	0° 34'.6 N., 119° 8'.5 E.	12 spec.
Stat. 95.	5° 43'.5 N., 119° 40' E.	1 spec.
Stat. 102.	6° 4'.1 N., 120° 44' E.	7 spec.
Stat. 137.	0° 23'.8 N., 127° 29' E.	1 spec.
Stat. 139.	0° 11' S., 127° 25' E.	3 spec.
Stat. 141.	1° 0'.4 S., 127° 25'.3 E.	1 spec.
Stat. 151.	0° 12'.6 S., 129° 48' E.	2 spec.
Stat. 178.	2° 40' S., 128° 37'.5 E.	10 spec.
Stat. 221.	6° 24' S., 124° 39' E.	5 spec.
Stat. 267.	5° 54' S., 132° 56'.7 E.	1 spec.

This species too has been recorded from many stations. The brown colour on the front part of the ventral side has quite disappeared in some specimens, which in other respects do not exhibit any difference with the other shells. From the literature on this species it may be inferred, that this species does not occur in the Atlantic. After BOAS and PELSENEER, it has been stated by PECK [1]) and SMITH [2]). PFEFFER [3]), MUNTHE [4]) and LOCARD [5]), however, have noted definite localities. It seems extremely rare in this ocean.

7. *Cavolinia longirostris* (Lesueur).

1821. *Hyalaea longirostris* Lesueur, in: DE BLAINVILLE, Dict. d. Sc. nat., vol. XXII, p. 81.
1821. *Hyalaea ecaudata* Lesueur, Ibid., p. 82.

1) Proc. U. S. Nat. Mus., vol. XVI, p. 452.
2) Proc. Zool. Soc. 1890, p. 254.
3) Abh. Naturw. Ver. Hamb., p. 84.
4) Pterop. i Ups. Un. Zool. Mus., Bih. till K. Sv. Vet-akad. Handl., Bd. 13, afd. IV, n° 2, p. 25.
5) Exped. Sc. Travailleur et Talisman, Mollusques testacés, t. I, p. 10.

1836. *Hyalaea limbata* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 101, pl. VI, figs. 11—15.
1836. *Hyalaea longirostra* d'Orbigny, Ibid., p. 100, pl. VI, figs. 6—10.
1850. *Cavolina longirostra* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 8.
1852. *Hyalaea angulata* Souleyet, Voyage de la Bonite, Zoologie, vol. II, p. 152, pl. V. figs. 1—6.
1852. *Hyalaea femorata* Gould, The Mollusca and Shells of the U. S. Exploring Expedition under the command of WILKES, pl. LI, fig. 603.
1861. *Hyalaea fissilabris* Benson, Notes on the Pteropodous Genus *Hyalaea*, etc., Ann. and Mag. Nat. Hist., ser. 3, vol. VII, p. 26.
1877. *Cavolina longirostris* Angas, Marine Mollusca of Port Jackson, Proc. Zool. Soc. London, p. 178.
1877. *Cavolina limbata* Angas, Ibid., p. 178.
1877. *Hyalaea obtusa* Sowerby, in: REEVE, Conch. Icon., vol. XX, Pteropoda, pl. II, fig. 8.
1888. *Cavolinia longirostris* Pelseneer, Chall. Rep. LXV, p. 79.

Living animals:

Stat. 35.	8° 0'.3 S., 116° 59' E.	3 spec.
Stat. 36.	7° 38' S., 117° 31' E.	8 spec.
Stat. 37.	Sailus ketjil, Paternoster Islands.	10 spec.
Stat. 66.	Between Bahuluwang and Tambolungan.	5 spec.
Stat. 89.	Pulu Kaniungan ketjil.	1 spec.
Stat. 96.	Pearl-bank, Sulu Archipelago.	± 20 spec.
Stat. 99.	6° 7'.5 N., 120° 26' E.	± 20 spec.
Stat. 106.	Kapul Island, Sulu Archipelago.	6 spec.
Stat. 109.	Pulu Tongkil, Sulu Archipelago.	3 spec.
Stat. 117a.	1° 15' N., 123° 37' E.	5 spec.
Stat. 118.	1° 38' N., 124° 28'.2 E.	2 spec.
Stat. 121.	Menado.	1 spec.
Stat. 136.	Ternate.	3 spec.
Stat. 138.	East coast of Kajoa Island.	4 spec.
Stat. 141.	1° 0'.4 S., 127° 25'.3 E.	1 spec.
Stat. 143.	1° 4'.5 S., 127° 52'.6 E.	3 spec.
Stat. 144.	Damar Island.	14 spec.
Stat. 148.	0° 17'.6 S., 129° 14.'5 E.	± 40 spec.
Stat. 165.	Daram Island.	10 spec.
Stat. 169.	Atjatuning, West coast of New-Guinea.	1 spec.
Stat. 172.	Gisser Island.	2 spec.
Stat. 177a.	2° 30' S., 129° 28' E.	8 spec.
Stat. 184.	South coast of Manipa Island.	1 spec.
Stat. 185.	3° 20' S., 127° 22'.9 E.	9 spec.
Stat. 194—197.	1° 53'.5 S., 126° 39' E.—1° 45'.3 S., 127° 8'.3 E.	5 spec.
Stat. 205.	Lohio Bay, Buton Strait.	4 spec.
Stat. 220.	Pasir Pandjang, West coast of Binongka.	1 spec.
Stat. 225.	Near the Lucipara Islands.	1 spec.
Stat. 276.	6° 47'.5 S., 128° 40'.5 E.	2 spec.

Empty shells:

Stat. 47.	Bay of Bima.	1 spec.
Stat. 51.	Molo Strait.	1 spec.
Stat. 59.	10° 22'.7 S., 123° 16'.5 E.	1 spec.
Stat. 88.	0° 34'.6 N., 119° 8'.5 E.	3 spec.
Stat. 89.	Pulu Kaniungan ketjil.	1 spec.
Stat. 90.	1° 17'.5 N., 118° 53' E.	10 spec.

Stat. 95.	5° 43′.5 N.,	119° 40′ E.	22 spec.
Stat. 102.	6° 4′.1 N.,	120° 44′ E.	17 spec.
Stat. 105.	6° 8′ N.,	121° 19′ E.	6 spec.
Stat. 137.	0° 23′.8 N.,	127° 29′ E.	3 spec.
Stat. 139.	0° 11′ S.,	127° 25′ E.	2 spec.
Stat. 151.	0° 12′.6 S.,	129° 48′ E.	5 spec.
Stat. 178.	2° 40′ S.,	128° 37′.5 E.	4 spec.
Stat. 211.	5° 40′.7 S.,	120° 45′.5 E.	1 spec.

The species is very abundantly distributed over the whole region.

No other species exhibits so many variations. Very striking is the difference in size among the specimens themselves. The lateral points of the small-sized individuals are generally less developed, the dorsal lip is not prolonged into a rostrum, and the shell is hyaline. In the larger specimens, however, the lateral points are more conspicuous, while the rostrum is long, and the shell coloured whitish. These characters are not absolutely connected with the size, and the opinion, according to which the small specimens represent young stages, is erroneous, as BOAS [1]) pointed out. They are adult individuals, like the large ones, which will not grow further.

Hyalaea angulata Souleyet was found at nearly every station from which *Cavolinia longirostris* has been recorded. But the transitions to this form are so numerous too, that it is impossible to regard the species of SOULEYET as a distinct one.

BOAS [2]) described a variety, in which the lateral points are more or less curved upwards. Some specimens of the collection, gathered by the Siboga, agree with his description (Stat. 102), but here, too, gradual transitions make it almost impossible to maintain the distinctness of this variety.

I may remark further that a small brown spot sometimes occurs on the dorsal side of the shell, just above the closing apparatus, while the strong dorsal median rib also exhibits a brownish colour of more or less extension. These characters, not in any way connected with any other constant peculiarity of the shell, do not allow me to make a new variety.

8. *Cavolinia inflexa* (Lesueur).

1813. *Hyalaea inflexa* Lesueur, Mémoire sur quelques animaux Mollusques, etc., Nouv. Bullet. Soc. Philom., vol. III, p. 285, pl. V, fig. 4, *A, B, C, D.*
1821. *Hyalaea elongata* Lesueur in: DE BLAINVILLE, Dict. d. Sc. Nat., vol. XXII, p. 82.
1835. *Hyalaea vaginellina* Cantraine, Bullet. Acad. d. Sc., Bruxelles, vol. II, p. 380.
1836. *Hyalaea labiata* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 104, pl. VI, figs. 21—25.
1836. *Hyalaea uncinata* Höninghaus in: PHILIPPI, Enum. Moll. utriusque Siciliae, vol. I, p. 101, pl. VI, fig. 18.
1841. *Hyalaea vaginella* Cantraine, Malac. médit., p. 28, pl. I, figs. 6—6*a*.
1850. *Cavolina inflexa* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 9.
1877. *Hyalaea (Diacria) inflexa* Sowerby, in: REEVE, Conch. Icon., vol. XX, Pteropoda, pl. III, figs. 17*a*—17*b*.
1877. *Hyalaea (Diacria) labiata* Sowerby, Ibid., figs. 18*a*—18*b*.

1) Spolia atlantica, p. 102.
2) L. c. s. 103.

1880. *Hyalaea imitans* Pfeffer, Die Pteropoden des Hamburger Museums, Abh. Naturw. Ver. Hamburg, Bd. VII, p. 90, pl. VII, fig. 9*a*.
1884. *Cleodora inflexa* Sowerby, Thes. Conch., vol. V, Pteropoda, pl. I, figs. 21—22.
1884. *Diacria labiata* Sowerby, Ibid., figs. 23—24.
1886. *Cavolinia inflexa* Locard, Prodrome de Conchyliologie française, p. 22.

Living animals:
Stat. 36. 7° 38′ S., 117° 31′ E. 1 spec.
Stat. 110. 4° 34′ N., 122° 0′ E. 1 spec.
Stat. 128. 4° 27′ N., 125° 25′.7 E. 1 spec.
Stat. 148. 0° 17′.6 S., 129° 14′.5 E. 1 spec.

Empty shells:
Stat. 88. 0° 34′.6 N., 119° 8′.5 E. 1 spec.
Stat. 223. 5° 44′.7 S., 126° 27′.3 E. 1 spec.

This species is not nearly so abundant as the foregoing one.

Hyalaea labiata d'Orbigny, regarded by the author, and many others after him, as a distinct species, is only a variety of the type. Boas [1]) described two varieties; one of them, *longa*, corresponds with *Hyalaea inflexa* (in the sense in which Souleyet [2]) uses the term), while the other variety is designated under the name of *lata (Hyalaea labiata* Souleyet [3]). But as in so many cases, these varieties are linked together (Pl. II, figs. 54—63).

The few specimens, brought home by the Siboga Expedition must be referred to the form *lata*, which lives in the South-Atlantic, Indian and West-Pacific Ocean (Boas).

Appendix to the Cavoliniidae.

Several zoologists have described new "species" which in reality represent only young stages of species, already known. Souleyet and Pfeffer have expressed in some cases, though hesitatingly, their doubt as to the specific distinctness of these small forms, referred to above; but it has been Pelseneer [4]) again who clearly pointed out their sexual immaturity.

But though it is certain, that those forms with their extremely flat shells, without completely developed closing apparatus, cannot be regarded as distinct species, it is almost impossible to decide, to what species they must be referred. The characters of the adult forms are only very vaguely expressed in the young ones, while on the other hand the embryonic shell of the latter is always wanting in adult specimens of some species. These circumstances prevent an exact solution of the question, which is not rendered more easy by the fact that several young stages have been described or figured in a way so incomplete, that I think it will be impossible to recognize the types, when occasionally found again.

Anatomical investigations (in the case of *Cleodora pygmaea* and *Pleuropus longifilis*) have shown me, that the gonad does not exhibit lamellar structure, as in the adult, but consists of numerous rounded follicles, just as in *Clio (Creseis)*. Those of larger size are eggs, while

1) Spolia atlantica, p. 123.
2) Souleyet, Voyage de la Bonite, vol. II, p. 156, pl. V, figs. 21—26.
3) Op. s. c. p. 159, pl. V, figs. 27—32.
4) Chall. Rep. LXV, p. 71.

numerous small cells, conglomerating especially around the efferent duct, probably represent spermatids. The gonad itself is situated on the median line, at its distal extremity, which is often curved to the left (at least in *Pleuropus longifilis*). Further information as to the anatomy of this last form may be found in the paper of GEGENBAUR [1]); I only mention the existence of a gastric coecum, dorsally to the liver and not situated in it, and two insertions of the very thin columellar muscle at the right side of the base of the terminal point, in which the shell ends. The dorsal insertion is situated more proximally than the ventral one.

Taking into consideration the questionableness of the true affinities of most of the young stages, I have thought it better to discuss them separately, and not together with the adult forms.

1. "*Cleodora compressa*" Souleyet. (Pl. II, fig. 64).

1850. *Clio depressa* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, *Pteropoda*, p. 14, (name only).
1852. *Cleodora compressa* Souleyet, Voyage de la Bonite, Zool, vol. II, p. 181, pl. VI, figs. 26—32.

Living animals:

Stat. 203. 3° 32'.5 S., 124° 15'.5 E.	1 spec.
Stat. 220. Pasir Pandjang, West coast of Binongka.	1 spec.
Stat. 282. 8° 25'.2 S., 127° 18'.4 E.	2 spec.

The shell as well as the animal shows much resemblance with *Cavolinia trispinosa* as PFEFFER [2]) already suggested. Very likely it is the young stage of this species. It is useless, to repeat the proofs of PFEFFER's opinion, as they have already been mentioned by PELSENEER [3]).

2. "*Cleodora pygmaea*" Boas.

1886. *Cleodora pygmaea* Boas, Spolia atlantica, Bidrag til Pteropodernes Morfologi, etc., p. 84, pl. 4, fig. 57, 57*bis*, pl. 5, fig. 90, pl. 4, fig. 50.

Living animals:

Stat. 36. 7° 38' S., 117° 31' E.	7 spec.
Stat. 37. Sailus ketjil, Paternoster Islands.	1 spec.
Stat. 110. 4° 34' N., 122° 0' E.	1 spec.
Stat. 136. Ternate.	4 spec.
Stat. 138. East coast of Kajoa Island.	1 spec.
Stat. 141. 1° 0'.4 S., 127° 25'.3 E.	4 spec.
Stat. 144. Damar Island.	13 spec.
Stat. 165. Daram Island.	2 spec.
Stat. 177a. 2° 30' S., 129° 28' E.	9 spec.
Stat. 185. 3° 20' S., 127° 22'.9 E.	1 spec.
Stat. 194—197. 1° 53'.5 S., 126° 39' E.—1° 45'.3 S., 127° 8'.3 E.	5 spec.
Stat. 203. 3° 32'.5 S., 124° 15'.5 E.	14 spec.
Stat. 205. Lohio Bay, Buton Strait.	2 spec.
Stat. 245. 4° 16'.5 S., 130° 15'.8 E.	1 spec.

This form, probably a young stage of *Cavolinia quadridentata*, "fills up a blank" as

1) Unters. üb. Pterop. u. Heterop. 1855, pl. I *(Hyalaea complanata)*.
2) Berl. Monatsber. 1879, p. 237.
3) Chall. Rep. LXV, p. 87.

PELSENEER [1]) says, as in the adult form the embryonic shell is always lacking. The dorsal ribs of "*Cleodora pygmaea*" agree with what is found in the form *costata* of *Cavolinia quadridentata*, occurring abundantly in the East-Indian Archipelago.

3. "*Pleuropus longifilis*" Troschel.

1854. *Pleuropus longifilis* Troschel, Beiträge zur Kenntniss der Pteropoden, Arch. f. Naturgesch., Jahrg. XX, p. 208, pl. VIII, figs. 1—3.
1855. *Hyalaea complanata* Gegenbaur, Untersuchungen über Pteropoden und Heteropoden, p. 40, pl. I, fig. 1.
1886. *Hyalaea longifilis* Boas, Spolia atlantica, Bidrag til Pteropodernes Morfologi, etc., p. 128, pl. 4, figs. 64—65, pl. 5, fig. 78.

Living animals:
Stat. 136. Ternate. 2 spec.
Stat. 220. Pasir Pandjang, West coast of Binongka. 1 spec.

This form has been recorded only from the Mediterranean, previous to the Siboga Expedition. It is certainly the young stage of *Cavolinia tridentata*, as PELSENEER [2]) pointed out. Like this author, I could trace, out of a certain number of specimens (procured from Naples by Dr. NIERSTRASZ), all the transitions between the young and the adult stage (Pl. II, figs. 36—53). In the seventh specimen of this series I observed a penis for the first time, and also a gill, while in the following specimens the gonad, situated more proximally than in the foregoing ones, consisted of lamellae.

4. "*Hyalaea rotundata*" Boas. (Pl. II, figs. 70—71).

1886. *Hyalaea rotundata* Boas, Spolia atlantica, Bidrag til Pteropodernes Morfologi og Systematik, etc., p. 129, pl. 4, figs. 59—61.

Living animals:
Stat. 36. 7° 38′ S., 117° 31′ E. 2 spec.
Stat. 189ª. 2° 22′ S., 126° 46′ E. 1 spec.

The description and figures given by BOAS, show clearly that this form presents close resemblance to *Cavolinia globulosa*, as BOAS himself affirms. It certainly corresponds with this species [3]). Living animals, belonging to the adult form, have rarely been met with by the Siboga Expedition; while the young animals were only represented by a few specimens.

5. "*Hyalaea levigata*" d'Orbigny. (Pl. II, figs. 72—73).

1836. *Hyalaea levigata* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 110, pl. VII, figs. 15—19.
1850. *Diacria laevigata* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 11.
1858. *Pleuropus laevigatus* A. and H. Adams, The Genera of recent Mollusca, vol. II, p. 611.

1) Op. s. c. p. 88.
2) Op. s. c. p. 71, 89.
3) See PELSENEER, Chall. Rep. LXV, p. 89—90.

Living animals:

Stat.	36. 7° 38′ S., 117° 31′ E.	± 60 spec.
Stat.	37. Sailus ketjil, Paternoster Islands.	± 200 spec.
Stat.	50. Bay of Badjo, West coast of Flores.	2 spec.
Stat.	169. Atjatuning, West coast of New-Guinea.	2 spec.

This form was referred to *Cavolinia longirostris* by PELSENEER [1]). His assertion seems, indeed, very admissible. The strong median dorsal rib in the adult, is already distinct in the young form.

Cavolinia longirostris is certainly the most common species of *Cavolinia* in the East-Indian Archipelago. For that reason "*Hyalaea levigata*" has been caught in very great numbers.

6. *Hyalaea depressa* d'Orbigny.

1825. ? *Pleuropus pellucidus* Eschscholtz, Bericht über die zoologische Ausbeute während der Reise von Cronstadt bis St-Peter und Paul, Oken, Isis, p. 735, pl. V, fig. 2.
1836. *Hyalaea depressa* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 110, pl. VII, figs. 11—14.
1850. *Clio pellucida (part.)* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 14.
1850. *Diacria depressa* Gray, Ibid., p. 11.
1852. ? *Cleodora pleuropus* Rang, Hist. nat. d. Moll. Pter., pl. X, fig. 8.
1853. *Cleodora curvata* Huxly, On the Morphology of the Cephalous Mollusca, etc., Phil. Trans. 1853, p. 42, pl. IV, figs. 4—5.
1858. *Pleuropus depressus* A. and H. Adams, The Genera of Recent Mollusca, vol. II, p. 611.

Living animals:

Stat.	36. 7° 38′ S., 117° 31′ E.	2 spec.
Stat.	130. 5° 0′ N., 125° 26′.5 E.	5 spec.
Stat.	144. Damar Island.	3 spec.

As to the species to which this form must be referred, it is certainly the young stage of *Cavolinia inflexa*. The general form of the shell and the curvature of the posterior portion support this opinion. One of the Siboga-specimens (Stat. 144) presents very close resemblance to the adult form, especially as regards the anterior part of the shell, in which the lips exhibit the same characteristic size as occurs in the form *labiata* of *Cavolinia inflexa*.

Anatomical Notes.

The anatomy of the genus *Cavolinia* (including the subgenera *Diacria* and *Cavolinia (s. str.)*) is sufficiently well known to dispense with a fresh description. Indeed, the first knowledge about the organisation of the "Pteropoda" in general, has been obtained for a great deal in studying the anatomy of *Cavolinia*. It has been the species *Cavolinia tridentata* especially which served most frequently for anatomical and histological researches.

It has been pointed out already by the thorough investigations of PELSENEER [2]), that the

1) Op. s. c. p. 90.
2) Chall. Rep. LXVI, p. 28—37.

genus *Cavolinia* is placed at the end of a series of forms, provided with external calcareous symmetrical shell, and is the most specialised genus in this direction.

It seems quite superfluous to repeat all that has been already stated by the different authors, especially VAN BENEDEN [1]), SOULEYET [2]), GEGENBAUR [3]), BOAS [4]), and PELSENEER [5]), who studied the anatomy of the genus in question. I shall only restrict myself to a few remarks, partly not agreeing with PELSENEER's publications, partly completing them.

There are several differences between the two subgenera *Diacria* and *Cavolinia (s. str.)*. Remarkable in *Diacria* is the separation of the liver into two lobes, having each its own duct. This arrangement does not occur in any other group of the Thecosomata. The flexure of the intestine is ventral in all *Cavoliniae*; it seems unnecessary to state this again, had not VOGT and YUNG [6]) been mistaken in this respect.

It must have been a slip of the pen, which made PELSENEER pretend that the heart in *Cavolinia* is on the right side. It is situated on the left.

The genital gland in *Diacria* occupies the whole posterior portion of the visceral mass, and is disposed transversely. In *Cavolinia (s. str.)*, however it is asymmetrical, situated almost quite on the left side, embracing the strong retractor muscle, while the lamellae of the gland exhibit the usual direction as in all Cavoliniidae. Transverse sections through this organ show, that the spermatozoids arise from inner folds of the membrane which envelops the gland. I could not notice any regularity as to the disposition of the ova in the gland, as several ova in different stages of ripening were found in the centre as well as at the periphery. According to GEGENBAUR (see above), the ova are produced in the outer parts of the lamellae, while KNOWER [7]) states that "the youngest ova are found in the centre, immediately around the intra-glandular portion of the duct, the oldest ova with considerable yolk at the periphery". I cannot agree with either of these statements. Perhaps further histological investigations will throw some light on the distribution of the ova in the genital gland.

The efferent duct in *Diacria* arises from the dorsal surface of the gland, quite at the right side, then runs over to the left, presenting the same characteristic elongated swelling as in *Clio* and opens into the accessory genital glands. This swelling of the efferent duct was also found in *Cavolinia inflexa*, contradictory to PELSENEER's statement, that this species "has an ovoid vesicula seminalis, with a very short duct".

In the other species of *Cavolinia (s. str.)* the efferent duct, proceeding from the right concave side of the genital gland, is very thin, until a long vesicula seminalis, coiled up at the left side of the stomach, opens into it. This vesicula seminalis is sometimes provided with small swellings from distance to distance [8]). The accessory genital glands in *Cavolinia (s. str.)*

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1) Exerc. Zool., Mém. Acad. Sci. Brux., vol. XII, 1839.
2) Voyage de la Bonite, vol. II, p. 100—136.
3) Unters. über Pterop. u. Het. 1855, p. 1—40.
4) Spolia atl. p. 86—91.
5) Op. s. c. p. 17—21.
6) Vergl. Anat. Bd. I, fig. 392 (p. 833).
7) Pteropods with two separate sexual openings, Ann. Mag. Nat. Hist. (6), vol. XIII, p. 529. 1894.
8) Not only in *Cavolinia longirostris*, as PELSENEER says, but also in *Cavolinia tridentata*.

are situated either on the left side of the stomach or ventrally to it; the albuminiparous gland is situated at the right anterior corner of the muciparous gland.

In *Diacria* there is a pyriform receptaculum seminis, while in *Cavolinia (s. str.)* the receptaculum seminis is scarcely visible, situated on the ventral side of the muciparous gland [1]), and with a very short duct.

KNOWER has described in *Cavolinia longirostris* a second sexual opening, leading from the muciparous gland directly into the mantle-cavity. He says: "on the left side of the uterine gland, sections in all planes show a second opening from the reproductive system to the exterior. This is a slit-like aperture on a slight papilla, on the anterior surface of the visceral sac and to the left. The opening leads directly into a ciliated fold of the uterine gland, the ciliated cells of which turn out at the lips of the aperture and become continuous with the epithelium of the external surface of the body".

I have also found this opening in *Cavolinia longirostris*, after examining series of transverse sections. In *Cavolinia tridentata* I could not see it. In the first species the opening just described was not on the left side of the muciparous gland, but on the dorsal surface. The cavity of the muciparous gland, developed at the right side, communicates with the mantle-cavity by an exceedingly small aperture, bordered by lips which exhibit the same histological structure as the external epithelium of the muciparous gland. This aperture is perhaps a vaginal opening, as KNOWER thinks; I must confess that the explanation of this second opening, never found in any other Thecosomatous "Pteropod", is not clear to me at all. Among the Bulloidea *Lobiger* and *Actaeon* also have a separate opening for each sex.

The ciliated seminal groove, leading to the penis, has become a closed ciliated tube in *Cavolinia longirostris*, as KNOWER already discovered.

As to the central nervous system, the form and disposition of the different ganglia is the same as that, found in all Cavoliniidae. I cannot, however, agree with PELSENEER that the pedal ganglia in all the species of *Cavolinia* show an anterior pedal commissure. This commissure does exist, according to my own investigations, in the subgenus *Diacria* and in *Cavolinia inflexa*, but I could never succeed in finding it, neither after most careful dissection nor in a series of transverse sections, in the other species of *Cavolinia (s. str.)*. In these species each pedal ganglion has a very large ganglionic cell on its proximal median side, but a second pedal commissure does not exist here. The visceral mass is asymmetrical; the pallial nerves, issuing from it, are very strong. From the anterior side of each cerebral ganglion (at least in *Cavolinia tridentata*, particularly examined on this point) rises only one tentacular nerve which, however, divides into several branches (Pl. II, figs. 78, 79).

The buccal ganglia are fused together into a single triangular mass, attached to the cerebral ganglia by a commissure. The nerves issuing from the buccal mass are disposed in the same manner as in *Clio*. This conformation of the buccal ganglia is characteristic for all the Cavoliniidae.

1) To my opinion, KNOWER (see above) has mistaken the distal end of the efferent duct in *Cavolinia longirostris* for a seminal receptacle.

Family III. Cymbuliidae.

1841. *Cymbulidae* Cantraine, Malacologie méditerranéenne et littorale, Mém. Acad. Sci. Brux., vol. XIII, p. 33.
1853. *Hyalidae (part.)* d'Orbigny, in Ramon de la Sagra, Histoire physique, politique et naturelle de l'île de Cuba, Mollusques, vol. I, p. 70.
1855. *Cymbuliea* Gegenbaur, Untersuchungen über Pteropoden und Heteropoden, p. 211.
1855. *Cymbuliacea* Troschel, Beiträge zur Kenntniss der Pteropoden, Arch. f. Naturgesch., Jahrg. XX, p. 210.
Hyalaeidae (part.) Auctorum.
1885. *Alata* Wagner, Die Wirbellosen des Weissen Meeres, Bd. I, p. 119.
Cymbuliidae Auctorum.

Though representatives of this family have been known for a long time, the true affinities of the Cymbuliidae were only recognised by Pelseneer [1]), according to whom the Cymbuliidae are not to be regarded as specialised Cavoliniidae (an opinion shared by the few authors who had an opinion of their own on this point), but "have descended from Limacinoid ancestors". Among the Limacinidae it is the genus *Peraclis* with which the Cymbuliidae (and especially the larvae) show the closest phylogenetic affinity.

As to the systematic relation of the group, the thorough revision of genera and species, made by Pelseneer [2]), has thrown some light on the chaos of names, generally applied to forms which had been described in an insufficient manner. Two circumstances have especially contributed to the incompleteness of our knowledge about the species, belonging to the family. In the first place the "shell" of the Cymbuliidae is very readily lost, the consequence of which is that species have been described as naked which in reality possess a "shell", and on the other hand some descriptions of species have been based on the examination of empty "shells" only, without animals. But in addition to this, the young forms of the Cymbuliidae differ greatly from the adult animals, the result of which was that several larvae were regarded as distinct species.

Taking these facts into consideration, it becomes obvious that new genera and species can only be established when the material at command is very complete, and shells with the animals *in situ* can be observed, so that no doubt can arise as to animal and shell belonging together.

The Siboga Expedition has brought home many Cymbuliidae, the greater part of which, however, are certainly young forms without shells. Little desirous to increase the number of incompletely known species, I shall abstain from describing such forms as "new" species, about which I am unable to give a complete diagnosis.

Whereas after the publication of Pelseneer's work the systematic relations of the Cymbuliidae to each other have undergone some alterations, I shall try to give again a revision of the various genera and species of the Cymbuliidae.

The generic names are the following:

Argivora Lesueur. *Cymbulia* Péron et Lesueur. *Desmopterus* Chun. *Tiedemannia* Delle Chiaje.
Corolla Dall. *Cymbuliopsis* Pelseneer. *Gleba* Forskål.

1) Challenger Report, LXVI, p. 31—32.
2) Challenger Report, LXV, p. 93—96.

The genus *Argivora* was based by LESUEUR on a small mollusc, first described by him [1]) as a naked *Cymbulia*; he called it *Cymbulia parva*, but proposed to erect for this form the new genus *Argivora*. The species has never been figured, and its description is very incomplete. Perhaps it is a small specimen of *Cymbuliopsis*, but absolute certainty cannot be obtained.

Corolla was established by DALL [2]) on a small specimen *(Corolla spectabilis)*; the genus, though very nearly related to *Tiedemannia*, differed from it in the pendant body and absence of a shell. The genus *Corolla* was declared by PELSENEER [3]) to be synonymous with *Gleba*. But DALL [4]) himself afterwards adknowledged the identity of *Corolla* with *Cymbuliopsis*.

Cymbulia of PÉRON et LESUEUR [5]) includes the species on which the whole family has been based. *Cymbulia peroni* from the Mediterranean is very well known and distinguished from other forms by a whole series of characters. The genus *Cymbulia* has therefore every right to exist.

The genus *Cymbuliopsis* was proposed by PELSENEER [6]) to receive some forms, formerly described as species of *Cymbulia*. Although the species of *Cymbuliopsis* resemble *Gleba* more than *Cymbulia* (the name *Cymbuliopsis* therefore being not very well chosen), yet there are some characters which justify the existence of PELSENEER's genus.

The form for which the genus *Desmopterus* has been erected [7]), seemed to exhibit such marked differences from any other "Pteropod", hitherto known, that the discoverer who regarded his *Desmopterus papilio* as a Gymnosomatous "Pteropod", established a new family Desmopteridae for it. The description and figures, given by CHUN, both of the external form of *Desmopterus papilio* and of its anatomy, support, however, strongly the belief that this species belongs to the Cymbuliidae, an opinion, already expressed by PELSENEER [8]). I have had occasion to prove the truth of the suggestion of this last author, as a species of *Desmopterus* was also found in the Siboga-material (Stat. 169, West coast of New-Guinea).

The only specimen (Pl. III, figs. 80—81) very much resembles *Desmopterus papilio*, but I have seen no pigment spots on the fins nor on the filiform appendages, which are rather short. In every other respect this specimen is so very much like the animal of CHUN that it is recognised at first sight as a *Desmopterus*.

As to the anatomy, after having made a series of transverse sections of the Siboga-specimen, I agree with CHUN in almost every respect. The radula, however, consists of three longitudinal series of teeth; in a transverse row, so there are three teeth; this fact does not correspond with the words of CHUN [9]) "etwa 20—30 Zähnchen sind in jeder Querreihe nachweisbar", and it procures an argument the more in favour of PELSENEER's opinion. It has become obvious by the explanations of this last author:

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1) In DE BLAINVILLE, Manuel de Conchyliologie, p. 655. The few words of DE BLAINVILLE are the only information we possess about this species.

2) Description of sixty new forms of Molluscs., etc. Americ. Journ. Conch. vol. VII, p. 137.

3) Challenger Report. LXV, p. 103.

4) Nautilus III, p. 30—32, 1889.

5) Ann. Mus. d'Hist. Nat. t. XV, p. 69, 1810.

6) L. s. c. p. 100.

7) CHUN, Bericht über eine nach den canarischen Inseln ausgeführte Reise, Sitz. Ber. Berl. Akad., 1889, vol. III, p. 540—546.

8) Sur la position systématique de *Desmopterus papilio* Chun, Zool. Anz., vol. XII, p. 525—526.

9) L. c. p. 541.

1° that the genus *Desmopterus* belongs to the Thecosomata.
2° that it must be referred to the Cymbuliidae.

Besides, I am of opinion that the specimen of CHUN and that of the Siboga Expedition are nothing but young stages of other species. This supposition is based on the following facts:
1° in the twisting of the liver into a spiral at the posterior end of the visceral mass; this twisting proves, that the animal has scarcely surpassed the embryonic stage, in which a calcareous external shell is present [1]).
2° In the position of the anus at the right side [1]).

Furthermore may be remarked, in favour of this opinion:
1° that a gonad is properly not present, as the polygonal ova, situated at the dorsal side of the stomach, are not joined by any connective tissue.
2° that any trace of a penis is absolutely wanting,
3° that the animal is very small; the greatest width across the fins is 3,5 mm.

The genus *Gleba* was founded by FORSKÅL [2]) on an animal which most zoologists after him called *Tiedemannia* [3]); these names being quite synonymous, the first of those must be retained.

So the three following titles remain:

(1) *Cymbulia.* (2) *Cymbuliopsis.* „ (3) *Gleba.*

It is very difficult to obtain absolute certainty as to the specific distinctness of many forms, referred to the Cymbuliidae. This is due to the fact, that most species have been described and figured by its discoverers in a way so vague and incomplete, that it is almost impossible to recognize the type on which the species has been based. PELSENEER is the only one who has tried [4]) to give short and clear diagnoses of all the forms, then known. Taking into consideration the literature on this subject and the material at my disposal, I propose the following diagnoses:

1. *Cymbulia*: proboscis short, and fixed to the fin; fins with a ventral lobe, ending in a whip-like process; on the dorso-lateral margin the fins exhibit an area devoid of muscular fibres [5]); muscular bundles are distinctly radiating towards the lateral and ventral margins of the fins, and in the ventral lobe. — Shell very thick, especially at the dorsal extremity, in which the cavity extends; slipper-like; covered with spines, which are arranged in rows parallel to the dorso-ventral axis.
2. *Cymbuliopsis*: proboscis projecting, free; fins with a continuous margin, without ventral lobe, on the surface of the fins three sets of muscles may be distinctly seen; the visceral nucleus is rounded at its aboral extremity, where it exhibits a dark pigmented ring or a spot. — Shell ovoid; with a large cavity and a broad aperture, about as long as the half-length of the shell; it is covered with rounded tubercles.

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1) See KROHN, Beiträge z. Entw.-Gesch. der Pterop. u. Heterop. Leipzig 1860.
2) Icones rerum naturalium, pl. XLIII, fig. D.
3) Erected by DELLE CHIAJE, in VAN BENEDEN, Exercices zootomiques, Nouv. Mém. Acad. Brux., vol. XII, p. 22.
4) L. c. 93, 96.
5) This area has been indicated in the figure of BOAS (Spolia atlantica, pl. 3, fig. 30) as a deep notch in the fin margin, while in reality there is only a slight sinuosity.

3. *Gleba*: proboscis free, projecting; fins with a continuous margin, without ventral lobe; on the latero-dorsal margin of the fins are some very complicated indentations; the three sets of muscles in the fins are only distinct at the margins, while in the centre only one of them, running dorso-ventrally, (so the one in which the bundles are all parallel to each other) may be distinguished. — Shell ovoid, flattened, with hardly any cavity; its dorsal margin is thickened, the ventral one is thin; sometimes covered with a few tubercles.

We shall now proceed to examine successively the two families, which have been collected by the Siboga.

Cymbulia Péron et Lesueur.

1810. *Cymbulia* Péron et Lesueur, Histoire de la famille des Mollusques Ptéropodes, Ann. Mus. d'Hist. Nat. Paris, vol. XV, p. 66.

For the characters of the genus, see above.

The right explanation of the organisation has been given by PELSENEER [1]). The elongation of the dorso-ventral axis of the shell has led most authors to believe that the pointed extremity was anterior and the truncated end posterior. An examination of the animal, however, without its shell, soon shows that this opinion is wrong, and removes at the same time the difficulty in comprehending PELSENEER's arguments, when these are heard for the first time. The only real difference between Cavoliniidae and Cymbuliidae is the presence of an internal cartilaginous shell in the latter. Both these families have descended from Limacinidae; the Cymbuliidae are more specialised with regard to pelagic life. — The figure of BOAS [2]) (though this author did not recognize the true phylogenetic affinity of the Cymbuliidae) may serve to make PELSENEER's opinion better understood.

I shall not enlarge upon the various "species" referred to the genus *Cymbulia*, as they have already been discussed by PELSENEER. In some cases figures and even description are entirely wanting, as in *Cymbulia obtusa* Lesueur [3]) (not mentioned by PELSENEER). Up to this time it is only one species we know fairly well. But even this form, *Cymbulia peroni*, has never been sufficiently figured. I have had occasion to study some specimens from the Mediterranean. After careful examination of the shell, I observed that the rows of spines were not quite similar in the different specimens. The large forms (62—43 mm.) one of which is figured on Pl. III, figs. 82—84, showed on the lateral side three parallel rows (fig. 83, *a*, *b*, *c*), while other specimens (42—26 mm.) possessed only one of these rows (fig. 86, *a*). In addition to this, the spines at the aperture which are of unequal size in the large specimens, especially at the right side where they are very strongly developed, are almost uniform in these small individuals. Are the latter young forms which have not reached a definite size? Or do they represent perhaps a new species, not hitherto observed? I can scarcely admit this last opinion, as the difference, above noted, among the specimens has never been recorded by any author

1) Challenger Report, LXV, p. 96—97.
2) Spolia Atlantica, p. 25, fig. G.
3) In DE BLAINVILLE, Manuel de Conchyliologie, p. 655.

who studied the Mediterranean species. The little material as yet at my disposal has not enabled me to decide upon the question; I, therefore, have restricted myself in figuring the two types only (Pl. III, figs. 82—87) and to indicate the difference between them, hoping to publish hereafter further researches of my own, in order to make out whether we have to do with two really distinct species or not.

PELSENEER [1]) described a second new species of which he had seen the shell only. This shell of *Cymbulia parvidentata* is distinguished especially by the constriction towards the middle of its length.

Finally a third species has been caught by the Siboga Expedition.

1. *Cymbulia sibogae* n. sp. (Pl. III, figs. 88—90).

Living animals:
Stat. 165. Daram Island. 1 spec.
Stat. 189[a]. 2° 22′ S., 126° 46′ E. 1 spec.

Empty shells:
Stat. 148. 0° 17′.6 S., 129° 14′.5 E. 8 spec.
Stat. 165. Daram Island. 1 spec.
Stat. 167. 2° 35′.5 S., 131° 26′.2 E. 2 spec.

Description: Shell slender, with the dorsal portion very much pointed; spines on the surface very small and all of nearly the same size, even those which surround the aperture. The rows of spines are arranged in nearly the same way as in the small type of *Cymbulia peroni*, but the two rows ending in the ventral points do not exhibit the constriction in its middle (compare figs. 87 and 90), being almost straight throughout their length.

The animal shows very great resemblance with *Cymbulia peroni*; I could not observe any marked difference from this species, except in the smaller size. The proboscis, the tentacles, the fins, the foot and the pallial gland (the latter was only preserved in the specimen of Stat. 165) are entirely like the corresponding organs in the Mediterranean species.

Dimensions: 24—11 mm.

Remarks:

I. This species exhibits some characters which are common to both the species of *Cymbulia*, actually known. It seems to have close affinity with *Cymbulia peroni* (the small type) but is distinguished from it:
   1° by the acute dorsal extremity.
   2° by the straight rows on the aboral surface of the shell; in *Cymbulia peroni* these rows are more sinuous.
   3° by the smaller size.
   4° by a shallower sinus at the ventral end.

1) L. s. c. p. 97, pl. II, figs. 12—13.

On the other hand it differs from *Cymbulia parvidentata*:

1° in having no constriction of the shell, nor the sharply marked angle of the two rows which end in the ventral points.

2° in the possession of two rows (fig. 90, *d*) reaching the middle of the shell; these rows do not run so far in *Cymbulia parvidentata* (the figure of PELSENEER is without accompanying letters).

II. Of the two specimens of this new species, which were attached to the shell, only one has been very well preserved (in formol 4%). The other is not in a good condition, as the pallial gland was damaged by the influence of alcohol. I have referred to this species the empty shells of the Siboga-material, though most of them are in a bad condition. Among these shells there are some of very small size, scarcely reaching 11—12 mm.

Some specimens of *Cymbulia*, with a ventral lobe to the fin, may be briefly described here. As the shells are wanting, I shall abstain from giving them any specific title.

A. A form (fig. 91) which bears a ventral lobe proportionnally longer than in *Cymbulia sibogae*, but in every other respect entirely like this species:

Stat. 99. 6° 7'.5 N., 120° 26' E. 1 spec.
Stat. 245. 4° 16'.5 S., 130° 15'.8 E. 2 spec.

B. A specimen (fig. 92) in which the dorso-lateral margin of the fin does not exhibit the characteristic area without muscular fibres; the width across the wings is only 6 mm.

Stat. 165. Daram Island. 1 spec.

C. Finally a specimen (fig. 93) with the same habitus as *Cymbulia sibogae*, very probably identical with it:

Stat. 143. 1° 4'.5 S., 127° 52'.6 E. 1 spec.

Anatomical Remarks.

The study of the little material at my disposal has given me occasion to note something about the anatomy which does not quite agree with former researches. Though my remarks are not complete, I hope to renew hereafter my researches at the Naples Zoological Station.

The pallial gland is asymmetrical; the right portion is more developed than the left, though this latter extends more ventrally. The proximal part of the gland is divided by a broad transverse asymmetrical band, which consists of two parts (Pl. III, fig. 94, *a*) The distal portion also exhibits a narrow band (*b*). My description differs a little from that of PELSENEER [1]).

The digestive tract. Two rounded salivary glands are situated just before the radula; they may be distinctly seen on transverse sections. The oesophagus is strongly

1) Chall. Rep. LXVI, p. 22, pl. III, fig. 8.

longitudinally folded and opens widely into the stomach. The posterior part of this latter has a strong layer of circular muscles. In the stomach are four large horny plates, two dorsally and two ventrally. Between the two dorsal plates, a little more distally, is situated a fifth triangular plate. The dorsal position of this posterior plate is remarkable, for in the Cavoliniidae it is situated on the ventral side. PELSENEER does not say whether this plate of the Cymbuliidae is dorsal or ventral.

The liver extends very far forward; it opens into the stomach, immediately behind the horny plates, by a very large opening, situated a little to the right of the median line. This wide hepatic duct soon divides into two. According to GEGENBAUR [1]) there are from three to six canals. SOULEYET [2]) mentions: "un conduit assez large qui s'ouvre à l'origine de l'intestin". Finally PELSENEER has seen two hepatic ducts. After receiving the hepatic duct the stomach exhibits dorsally a large and short coecum, in which the brown villi of the stomach extend. A long intestine is coiled up in the liver and in the gonad; its walls are extremely thin, consisting only of one layer of flat ciliated cells. The intestine is curved in the same way as in the Cavoliniidae; the anus, however, is quite ventral, scarcely reaching the median line, whereas, as one knows, in the Cavoliniidae the anus is situated at the left side.

The generative organs. The gonad is especially developed on the left side, but distally it occupies the whole posterior portion of the visceral mass. It is composed of lamellae as in the Cavoliniidae; the histological structure too is nearly the same, but I found the ova in the central portion; peripherically the spermatozoids cling together. At the anterior part of the gland, at its concave side, a narrow duct proceeds from it (Pl. III, fig. 95, *a*). This duct, with occasional dilatations, surrounds the accessory genital glands, which are situated before the stomach, on the ventral side. The large muciparous gland (*b*) is strongly folded, especially on the ventral surface; a small albuminiparous gland (*c*) may be distinguished at the right side. The latter shows a peculiar external structure of bunch-like elevations. Between the two glands a receptaculum seminis with a rather long duct (*d*) is situated, and here too a vas deferens (*e*), soon becoming a spermatic groove, arises.

The penis opens in the middle line, behind the tentacles. The walls of the copulatory organ are very strongly folded, and there is an epithelium of high cells with deeply staining nuclei, which is so characteristic of the Cavoliniidae, but no horny stylet in the cavity of the penis.

The central nervous system. A short description may be sufficient, as the nervous system has already been recognised in its peculiarities by PELSENEER [3]).

The cerebral ganglia, situated at the side of the oesophagus as in all Thecosomata, and united by a long supra-oesophageal commissure, are rather elongated (Pl. III, figs. 97—98, *c*). The pedal ganglia (*p*) are the largest, coloured whitish, and nearly circular. The second pedal commissure (figs. 96, 98, *a*) has not been figured nor mentioned in this genus by any previous author. In the arrangement of the visceral ganglia (*v. p. v.*) is shown again the phylogenetic affinity to *Peraclis*. These ganglia are three in number and disposed symmetrically; the two outer

1) Untersuchungen über Pteropoden und Heteropoden, p. 48.
2) Voyage de la Bonite, vol. II, p. 234.
3) L. s. c., p. 24—26, pl. III, figs. 10—11.

ones are of the same size, somewhat smaller than the median (*p. v.*). The lateral visceral ganglia (fig. 97, *v*) are not in any way connected with the pedal ganglia, but with the cerebral ones. So the central nervous system is quite symmetrical. The distribution of the nerves is the following:

From the anterior part of each cerebral ganglion three nerves proceed (fig. 97—98, 6—8). A slight sinuosity, already observed by PELSENEER, divides the ganglion into two segments; from the dorsal segment the tentacular nerve arises (6); the two other nerves supply the proboscis.

The pedal ganglia give origin to two large nerves (figs. 96—97, 1), ramifying very widely into the fins, as may be seen in fig. 99. Two of the branches extend in the ventral lobe of the fin. Besides, from each pedal ganglion issues a nerve, directed forward (fig. 98, 9—10); a similar nerve occurs in *Cuvierina*. I could not make out which part of the animal is innervated by these nerves, (perhaps the retractor muscle of the proboscis).

From each lateral visceral ganglion a very strong mantle-nerve proceeds (fig. 96, 2—3); two nerves innervating the visceral mass, issue from the median visceral ganglion. The stronger of these nerves (5) proceeds from the posterior part of the ganglion, slightly to the left, another, very thin, arises from the right side (5). The implantation of (4) and (5) is the only clearly marked asymmetry in the nervous system.

The buccal ganglia are closely approximated, but yet distinct. These ganglia, as well as the nerves issuing from them, have already been described and figured by PELSENEER [1]).

Cymbuliopsis Pelseneer.

Cymbulia (part.) Auctorum.
1872. *Corolla* Dall, Description of sixty new forms of Molluscs from the West coast of North-America and the North Pacific Ocean, Americ. Journ. of Conch., vol. VII, p. 137.
1888. *Cymbuliopsis* Pelseneer, Chall. Rep., LXV, p. 100.

The species of DALL is very imperfectly known, and as no figure exists of *Corolla spectabilis* and its diagnosis, given by DALL, consists only in the negative character of the absence of a shell, it remains doubtful whether the species belongs to *Cymbuliopsis*, notwithstanding DALL's assertion (see p. 51). The genus is distinguished from *Cymbulia* and *Gleba* by the presence of a shell with a very large cavity and thin walls. The animal very closely resembles *Gleba*, having a proboscis, free throughout its length, a fin without ventral lobe, and with neither radula nor jaws. As far as I can judge, however, it differs from *Gleba* by the three very distinct muscular systems in the fin, and in the absence of the indentations on the fin margin. As only very few species of both these genera are known, it is very probable that other forms, not yet discovered, will link together the two types.

The discrimination of the species of *Cymbuliopsis* was no easy task, as the type-specimens have been very imperfectly described, and scarcely any attempt has been made to compare the various species mutually [2]).

1) L. s. c., p. 26, pl. IV, fig. 2.
2) A laudable exception is made by PELSENEER (Chall. Rep., LXV, p. 100—101).

Three species have been described in literature. They are the following:

1. "*Cymbulia*" *ovata* Quoy and Gaimard.
2. "*Cymbulia*" *calceola* Verrill.
3. *Cymbuliopsis vitrea* Heath and Spaulding.

"*Cymbulia*" *ovata* is very imperfectly known; I shall discuss this species further on.

The summary description [1]) given by VERRILL, of "*Cymbulia*" *calceola* and especially the smallness of the rather schematical figure [2]) does not allow absolute certainty as to the specific distinctness of the species, about which, however, we possess a rather extensive anatomical and histological study by PECK [3]). It is possible that the "*Tiedemannia*" mentioned by BOAS [4]) may be identical with "*Cymbulia*" *calceola*. At any rate the specimen of BOAS is a *Cymbuliopsis* as is elucidated by the shortness of the proboscis and the three distinct muscular sets in the fin.

Cymbuliopsis vitrea [5]) is somewhat better known; it seems to resemble very closely the preceding species. Perhaps it is the same as *Corolla spectabilis*, and consequently also identical with the form obtained by the Challenger Expedition [6]), these forms occurring in the same locality (North Pacific Ocean).

None of the specimens of *Cymbuliopsis* in the Siboga-material can be identified with any of the foregoing species. At least one new species may be established. Taking into account the incompleteness of the description and the figures, given by QUOY and GAIMARD, it remains doubtful whether the specimens from the British Museum, described by PELSENEER [7]), belong really to *Cymbuliopsis ovata*. The same is true of *Cymbuliopsis calceola*, the anatomy of which was studied by PECK (see above). The diagnosis of this species, procured by its discoverer, is insufficient. I have tried to give a synopsis of the species of *Cymbuliopsis*, actually known.

Synopsis of the species.

1.	Shell somewhat pointed at its ventral margin; aperture shorter than half the length of the shell	*Cymbuliopsis ovata.*
	Shell rounded at the two extremities, aperture longer than half the length of the shell.	2.
2.	Fins projecting beyond the ventral margin of the shell almost half its width	*Cymbuliopsis vitrea.*
	Ventral margin of the shell extending nearly as far as the anterior border of the fins	3.
3.	Tubercles regularly placed all over the shell	*Cymbuliopsis calceola.*
	Tubercles irregularly placed, smaller and closely grouped together on the aboral surface of the shell; entirely absent at the ventral margin	*Cymbuliopsis intermedia.*

1) In: Americ. Journ. Sci. and Arts, vol. XX, p. 392—394, 1880.
2) In: Transact. Connect. Acad., vol. V, pl. LVIII, fig. 33.
3) Stud. Biol. Lab. J. Hopkins Univ., vol. IV, p. 335—553.
4) Spolia atlantica, p. 141, p. 3, fig. 31.
5) HEATH & SPAULDING, Proc. Ac. Nat. Sci. Philadelphia, vol. LIII (1901), p. 509—511).
6) PELSENEER, Chall. Rep., LXV, p. 104.
7) L. s. c. p. 100, pl. II, figs. 15—16.

Two species have been observed in the East-Indian Archipelago as yet.

*1. *Cymbuliopsis ovata* (Quoy and Gaimard).

1832. *Cymbulia ovata* Quoy and Gaimard, Voyage de l'Astrolabe, vol. II, p. 373, pl. 27, figs. 25—30.
1852. *Cymbulia ovularis* Rang, Histoire naturelle des Mollusques Ptéropodes, pl. XI, figs. 1—6.
1888. *Cymbuliopsis ovata* Pelseneer, Chall. Rep. LXV, p. 100, pl. II, figs. 15—16.

This species, with short aperture and regularly placed tubercles, was found by Quoy and Gaimard in very large shoals off Amboina. Since then, however, never any other locality has been recorded, and at Amboina it was never found again, even not by the Siboga Expedition.

Souleyet [1]) thinks that Quoy and Gaimard, figuring the species, were mistaken as to the relative position of the animal to its shell; in this respect, however, the figure is exact, though otherwise it is not very reliable. Those of Pelseneer are decidedly better, but the animal is not figured, and Pelseneer does not say, whether the specimen which served him for anatomical study, belonged to this species or not.

2. *Cymbuliopsis intermedia* n. sp. (Pl. IV, figs. 100—104).

Living animals:
Stat. 144. Damar Island. 1 spec.

Empty shells:
Stat. 48. 8° 4'.7 S., 118° 44'.3 E. 1 spec.
Stat. 166. 2° 28'.5 S., 131° 3'.3 E. 1 spec.
Stat. 167. 2° 35'.5 S., 131° 26'.2 E. 3 spec.
Stat. 295. 10° 35'.6 S., 124° 11'.7 E. 1 spec.
Stat. 312. 8° 19' S., 117° 41' E. 1 spec.

Description: The shell exhibits the usual characters of *Cymbuliopsis*. The aperture is always somewhat longer than half the length of the shell. In the distribution of the tubercles I could not observe any regularity; on the aboral surface are some which are smaller, more closely grouped together; at the ventral margin there are none (figs. 102, 104). This character of the shell agrees partly with what is found in *Cymbuliopsis vitrea*. Aperture unarmed, thickened lateral sides; these thickenings disappear towards the ventral margin. Tubercles at the oral surface sometimes fused together into mere unevennesses, separated by shallow grooves. Animal as in other species of *Cymbuliopsis*; proboscis short and broad, tentacles very short; fins with three distinct systems of muscles; anterior border of the fins scarcely projecting the ventral margin of the shell (almost as in *Cymbuliopsis calceola*); pallial gland twisted to the left, with three transparent bands.

Dimensions: 39—23 mm. Shell of Stat. 144: 30 mm.

Colour of the shell: Generally transparent, sometimes yellowish, or even dark-brown (alcohol- and formol-specimens).

1) Hist. nat. d. Moll. Ptérop. p. 68.

Remark:

I. The description is taken especially from the specimen of Stat. 144, which was still attached to the shell. The empty shells are so much alike the one of Stat. 144, that, to my opinion, they equally belong to *Cymbuliopsis intermedia*.

Several specimens of *Cymbuliopsis* without shell were found by the Siboga. I shall not give them any specific title. In the general aspect of the animals I cannot observe any marked difference from the species above described. The dimensions, however, are sometimes quite different, and vary from 35 to 6 mm. The formol in which the specimens for the greater part have been preserved, has seriously damaged the mantle-organs, the pallial gland, and even the nucleus.

One of the specimens is figured on Pl. IV, fig. 105.

They were found at the following localities:

Living animals:

Stat. 124. 2° 27′ N., 125° 35′ E. 1 spec.
Stat. 141. 1° 0′.4 S., 127° 25′.3 E. 1 spec.
Stat. 148. 0° 17′.6 S., 129° 14′.5 E. 1 spec.
Stat. 165. Daram Island. 1 spec.
Stat. 167. 2° 35′.5 S., 131° 26′.2 E. 1 spec.
Stat. 185. 3° 20′ S., 127° 22′.9 E. 2 spec.

The specimen of Stat. 167 is perhaps a *Cymbuliopsis intermedia*, as at this same station three shells of this species have been collected.

Some larval forms of Cymbuliidae have been recorded by the expedition. The general habitus of these larvae differs very much. Some of the forms are figured on Pl. IV, figs. 106—108. They bear curious appendages to the fins. Their affinity to any adult form cannot be made out; very probably they belong to various genera.

The following localities were recorded:

Living animals:

Stat. 141. 1° 0′.4 S., 127° 25′.3 E. 4 spec.
Stat. 143. 1° 4′.5 S., 127° 52′.6 E. 8 spec.
Stat. 185. 3° 20′ S., 127° 22′.9 E. 8 spec.
Stat. 203. 3° 32′.5 S., 124° 15′.5 E. ± 15 spec.
Stat. 225. Near the Lucipara Islands. 2 spec.
Stat. 276. 6° 47′.5 S., 128° 40′.5 E. 1 spec.

The specimen without shell of the Challenger (Chall. Rep. LXV, p. 99) is a larva, as it bears appendages to the fins. I have studied this specimen in the British Museum.

Anatomical Remarks.

The close resemblance which *Cymbuliopsis* shows to *Gleba*, is also markedly expressed by the visceral anatomy of both genera.

The information we possess regarding the anatomy of *Cymbuliopsis* is restricted to a

few remarks of PELSENEER [1]), a study by PECK [2]) on *Cymbuliopsis calceola*, and a preliminary note of HEATH and SPAULDING [3]) on *Cymbuliopsis vitrea*. About *Gleba* we know something more, especially after the researches of VAN BENEDEN [4]), GEGENBAUR [5]) and PELSENEER [6]).

As I have had an opportunity to examine some specimens of *Gleba*, brought home from the Naples Station by Dr. NIERSTRASZ, I have been able to compare the results of my examinations of *Gleba* with those, obtained from the study of *Cymbuliopsis*. Some specimens of this latter genus were investigated by making a series of transverse sections.

As no sufficient drawing of *Gleba cordata* exists, and in order to show the muscular fibres in the fins, already alluded to, a figure is given on Pl. IV, fig. 109. Fig. 110 represents the shell. In the small specimens, however, the shell bears no tubercles, and is perfectly smooth. I may further remark, that the number of indentations is not always five, but varies in different specimens from six to four.

The pallial gland presents a similar aspect in both genera (Pl. IV, figs. 111—112). It is somewhat asymmetrical, and three transverse bands divide the shield in four parts. The most proximal of these bands (*a*) is very narrow, the second (*b*) is the broadest and asymmetrical while the most distal (*c*) does not divide the pallial gland over its whole breadth, as this band does not reach the right side. In *Cymbuliopsis* as well as in *Gleba* the pallial gland is twisted slightly to the left, contradictory to PECK, who described and figured the pallial gland of *Cymbuliopsis calceola*, as twisted to the right. Neither radula, nor jaws or salivary glands are found in each of the genera. The very long oesophagus is more markedly separated from the stomach as in *Cymbulia*. In the stomach, situated quite dorsally and slightly to the right in the visceral nucleus, are found the same horny masticatory pieces as in *Cymbulia*, the fifth plate being equally dorsal, as PECK stated already in the species, studied by him. A coecum could scarcely be indicated, and was even entirely absent in *Cymbuliopsis*. A little to the right of the median line opens the liver with a very large opening. The liver occupies almost the whole visceral nucleus, extending proximally even as far as the central nervous system, so that its proximal end is interposed between the ganglia and the oesophagus. Immediately beneath the hepatic opening a very thin intestine arises which takes its direction to the left side, and then runs on at the dorsal side of the stomach to the right. Though the extreme portion of the rectum is directed to the left, the anus does not reach the median line, and opens to the right of it (Pl. IV, fig. 113).

The heart and the kidney are situated above the visceral mass. The kidney (Pl. IV, fig. 114, *b*) has a semi-lunar shape, and at its concave side, towards the nucleus, is found the heart (*a*). Both these organs are situated nearly in the median line, but the left lobe of the kidney is slightly more developed than the right. The opening into the mantle-cavity is found at the right side (*d*); it is represented in the figure in a contracted state. I have not found,

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1) Challenger Report, LXVI, p. 26—27.
2) Stud. Biol. Lab. J. Hopk. Univ., vol. IV, p. 335—353.
3) Proc. Ac. Nat. Sci. Philadelphia, vol. LIII (1901), p. 509—511.
4) Acad. Roy. de Bruxelles, tome XII, p. 21—27, pl. II.
5) GEGENBAUR. Untersuchungen über Pteropoden und Heteropoden, p. 54—68.
6) L. s. c., p. 27—28.

however, the reno-pericardial opening, neither in *Gleba* nor in *Cymbuliopsis*. GEGENBAUR and PECK have equally sought in vain for this opening. The pallial cavity of most of the specimens of *Cymbuliopsis* at my disposal being in a very damaged condition, I have not ventured to sacrifice the only type-specimen of *Cymbuliopsis intermedia*, that I might perhaps discover this opening. In *Gleba* I did not succeed in finding it, notwithstanding many attempts.

In this genus, however, I have found an opening (*e*) in the mantle, at the right side. It is oval and surrounded by a sphincter; the pallial cavity communicates through it with the exterior. The presence of this opening seems to me quite unique; I could not discover in literature any mention made about it. — The heart "hat so ziemlich die Gestalt eines Kartenherzens" as GEGENBAUR already said. On its walls, as on those of the wide aortae, large nuclei are distinctly visible. GEGENBAUR mentions three vessels proceeding from an aorta, I have seen only two of them (ao_1, ao_2); and an auricle I did not observe at all. Readily admitting the incompleteness of my description of the excretory and circulatory organs, I hope, however, to take these studies up again as soon as possible.

About the generative organs I can scarcely mention anything. For it is a peculiar fact that any trace of a gonad, of accessory genital glands and even of a penis, is entirely wanting in some specimens. The lack of a penis has already been recorded by PECK. The gonad is distributed over the visceral nucleus as a thin sheet. As to the genital duct and the accessory glands, I could not observe anything with some certainty. GEGENBAUR's description, and especially his figure of the generative organs in *Gleba*, seems *a priori* somewhat strange.

The central nervous system resembles very much that of *Cymbulia*. The number and disposition of the ganglia is the same (figs. 115—116). The cerebral ganglia (*c*) are elongated; at their anterior side a segmentation presents itself, which is more clearly marked in *Gleba*; at their posterior side a globular swelling is visible in *Cymbuliopsis*, while in *Gleba* this swelling is divided into two or, strictly speaking, three smaller ones. As PELSENEER already remarked, nerves do not proceed from these swellings. The cerebral commissure is extremely long, and distinctly separated from the cerebral ganglia. The arrangement of the pedal (*p*) and visceral ganglia (*v. p. v.*) is quite similar to that in *Cymbulia*. A small anterior pedal commissure is equally found here. The posterior visceral ganglion is somewhat larger than the two lateral. According to the figure of PECK the three visceral ganglia are of the same size. The nerves arising from the ganglia are disposed in exactly the same manner as in *Cymbulia*, at least as regards the pedal and visceral ganglia. — From the anterior side of the cerebral ganglia only two nerves issue (not three as in *Cymbulia*). Both these nerves arise from the ventral segment. The more ventral (1) which is the stronger and somewhat swollen at its base, supplies the tentacle, a very thin and slender nerve (2) goes to the penis. This latter nerve does not seem to have been perceived either by PECK, or by PELSENEER. The first author mentions two cerebral nerves of which the dorsal supplies the tentacle, while the other innervates the proboscis. I cannot agree with this explanation, for according to my investigations, the nerve to the proboscis proceeds from the pedal ganglion. PELSENEER has only made reference to the tentacular nerve in *Gleba*. — The pedal ganglia give origin to the same nerves as in *Cymbulia*: two large nerves (4,5), ramifying widely into the fins (fig. 117), issue

from each ganglion. From the anterior side a slender nerve (3) innervates the proboscis; PELSENEER first spoke about this nerve in *Gleba*. — From the visceral ganglia four nerves arise; each mantle-nerve (6) soon divides into two branches; the lower branch of the right nerve supplies the osphradium. The two nerves of the posterior visceral ganglion innervate the visceral mass.

The two juxtaposited buccal ganglia, close to the oesophagus, are situated a little before the pedal ganglia. The arrangement of these ganglia is characteristic of the Cymbuliidae as well as of the Limacinidae.

GYMNOSOMATA de Blainville.

1824. *Gymnosomata* de Blainville, Dict. d. Sci. Nat., vol. XXXII, p. 271.
1885. *Deutocephala* Wagner, Die Wirbellosen des weissen Meeres, Bd. I, p. 119.
1886. *Pterota* Boas, Spolia atlantica, K. dansk. Vidensk. Selsk. Skriv., 6 Raekke, Bd. IV, p. 14.

The Gymnosomata form a group among the Tectibranchia which exhibits the nearest affinity with the Aplysioidea. For that reason they are not so closely related to the Thecosomata (which are Bulloidea modified in adaptation to their pelagic life) as to unite these two groups to the order "Pteropoda". In spite of many points of resemblance, generally based on convergence, the whole organisation of the Gymnosomata is quite different from that of the Thecosomata. Both these groups possess a different origin.

This important fact, already alluded to by Boas [1]), has been amply discussed by Pelseneer [2]) who, correcting some of Boas' suggestions, was the first to trace out the phylogenetic affinity of the Gymnosomata (see also p. 6).

From a systematic point of view the Gymnosomata were very unsatisfactorily known, not yet twenty years ago. Now, it is true, that the study of these animals, still more than that of the Thecosomata, is made difficult by several facts. First the animals are generally very small, and their bodies being strongly and irregularly contracted in the preserving fluid, it is not easy to describe their true shape. In the second place the buccal appendages, on which the systematization is mainly based (at least as regards the species of the same genus), are nearly always retracted in preserved specimens, and not visible externally. Finally, the gills are often concealed under the large folds of the body-wall. And so, every point for a right conception, regarding the systematic position of any member of the Gymnosomata, can only be obtained by means of careful examination and dissection.

Notwithstanding the acknowledgment of the difficulties above mentioned, one can scarcely suppress an angry feeling against such authors as Quoy and Gaimard, Bruguière, and even Rang. For these naturalists, describing "new species" without indicating any specific distinctness, and, indeed, destitute of any knowledge about the organisation of these animals, have been the

1) Spolia atlantica, p. 179.
2) Chall. Rep. LXVI, p. 82—88.

cause that these "species" are now very vaguely known, and will remain so in the literature on the Gymnosomata, without much possibility that other naturalists may recognize them with certainty.

Though the studies of CUVIER, ESCHRICHT, DE BLAINVILLE, VAN BENEDEN, SOULEYET, GEGENBAUR, TROSCHEL, MÜLLER, FOL, KROHN and WAGNER — treating of whole groups or of a single species only — have decidedly their merits, it was not until BOAS and PELSENEER took up their tasks, that the systematic classification of the Gymnosomata became clearly established. Many of the species formerly described, ought to be obliterated as real species, as their characterization is insufficient, only a few should remain. On the other hand, the number of distinct species was importantly increased by the two last-mentioned zoologists. The result of their monographs was, that twenty-one species were then really known. These species belonged to five families and seven genera (PELSENEER).

It may be supposed, however, that we know only a small number of the species, really existing in our seas. So, from the Mediterranean some peculiar larvae were formerly described by GEGENBAUR [1]), which since that time no naturalist has found again, at least not in the adult state, but which belong to a genus *Thliptodon*, established by BOAS [2]). Many of the species, badly described by previous authors, may nevertheless represent curious types, about the characters of which we unfortunately do not possess sufficient information. According to the preliminary notes of MEISENHEIMER, there has already been found in the material of the Valdivia Expedition a new family, Pteroceanidae [3]), and one new genus *Schizobrachium* [4]).

And finally the results of the Siboga Expedition show that explorations in a rather limited area, as the eastern part of the Indian Archipelago, may procure very sufficient results. For six genera, one of which is new, are represented in the collection, while the number of species amounts to eight. Five of them had not been described before.

Family I. PNEUMONODERMATIDAE.

1840. *Pneumodermidae (part.)* Gray, Synopsis of the contents of the British Museum, p. 86.
1846. *Pneumodermidae* Agassiz, Nomenclator zoologicus, Index, p. 299.
1853. *Pneumodermidae (part.)* d'Orbigny in Ramon de la Sagra, Histoire physique, politique et naturelle de l'île de Cuba, Mollusques, vol. II, p. 70.
1855. *Clioidea (part.)* Gegenbaur, Untersuchungen über Pteropoden und Heteropoden, p. 212.
1856. *Cliidae (part.)* Woodward, A Manual of the Mollusca, p. 208.
1858. *Pneumodermonidae (part.)* H. and A. Adams, The Genera of recent Mollusca, vol. I, p. 62.
1862. *Pneumodermidae* Bronn, Die Klassen und Ordnungen des Thierreichs, Bd. III, p. 645.
1863. *Pneumodermacea* Troschel, Das Gebiss der Schnecken, Bd. I, p. 56.
1871. *Pneumodermatidae* Dall, Description of sixty new forms of Molluscs from the West coast of North America, Americ. Journ. Conch., vol. VI, p. 139.
1887. *Pneumonodermatidae* Pelseneer, Challenger Report, LVIII, p. 11.

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1) Untersuchungen über Pteropoden und Heteropoden, p. 95—97, pl. V, fig. 14—15.
2) Spolia atlantica, p. 174.
3) Zool. Anz., Bd. XXVI, p. 92—99.
4) Ibid., p. 410—412.

The characters of this family, which includes a rather large number of species, were established by PELSENEER. According to his researches and those of BOAS, three genera may be properly distinguished:

1. *Dexiobranchaea* Boas [1]).
2. *Spongiobranchaea* d'Orbigny [2]).
3. *Pneumonoderma* Cuvier [3]).

These three genera are all characterised by the presence of suckers on the ventral side of the buccal cavity and of a gill on the right side.

If the genus *Schizobrachium* Meisenheimer [4]) really belongs to this family, the possession of a lateral gill is no longer characteristic of the Pneumonodermatidae, and so only the suckers remain, either situated on buccal appendages or directly inserted on the ventral wall of the buccal cavity. I deem it, however, better to await MEISENHEIMER's extensive monograph on the Gymnosomata of the Valdivia Expedition, before it can be ascertained with certainty whether *Schizobrachium* must be referred to the Pneumonodermatidae or not.

Of the four genera above named, only one was represented in the material collected by the Siboga. It is the genus:

Pneumonoderma Cuvier.

1804. *Pneumoderma* Cuvier, Mémoire concernant l'animal de l'Hyale, etc., Ann. Mus. d'Hist. Nat. Paris, vol. IV, p. 232.
1810. *Pneumoderma* Péron and Lesueur, Histoire de la famille des Mollusques Ptéropodes, Ann. Mus. Hist. Nat. Paris, vol. XV, p. 65.
1815. *Pneumodermis* Oken, Lehrbuch der Zoologie, Bd. I, p. 326.
1815. *Aegle* Oken, Ibid., p. 326.
1817. *Pneumodermon* Cuvier, Le Règne animal, vol. II, p. 380.
1846. *Pneumonoderma* Agassiz, Nomenclator Zoologicus, Index, p. 299.
1855. *Pneumonodermum* Herrmannsen, Indicis generum Malacozoorum primordia, vol. I, p. 309.
1879. *Cirrifer* Pfeffer, Übersicht der während der Reise um die Erde ..... auf S. M. Schiff "Gazelle" und von Hrn. Dr. JAGOR ..... gesammelten Pteropoden, Monatsber. Ak. Wiss. Berlin, p. 249.

This genus is chiefly characterised by the presence of two acetabuliferous buccal appendages, the suckers of which do not increase in size from the base of the appendage to its distal extremity — and by the great development of the lateral and the posterior gill.

After the investigations of BOAS [5]) and PELSENEER [6]) we now know six species of this genus. Most of the forms, described by authors previous to the above-mentioned zoologists, were either identical with other species already known or too insufficiently characterised. Some of

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1) Vorläufige Mittheilung über einige gymnosomen Pteropoden, Zool. Anz., Jahrg. VIII, p. 688.
2) Voyage dans l'Amérique méridionale, vol. V, p. 130.
3) Mémoire concernant l'animal de l'Hyale, etc., Ann. Mus. d'Hist. Nat. Paris, vol. IV, p. 232. It has not become clear to me, why PELSENEER has used the name *Pneumonoderma* and not *Pneumodermon*.
4) Zool. Anz., Jahrg. XXVI, p. 410—412.
5) Spolia Atlantica. p. 151—155.
6) Challenger Report LVIII, p. 23—32.

these forms I shall have to discuss further on, as they were obtained within the area of exploration of the Siboga.

The material of this expedition contains three species, two of which are new. One species, recorded from the East-Indian Archipelago has not been obtained.

I may lay stress on the fact that it is often very difficult to distinguish the species from each other. The body being strongly contracted, it is by no means easy to discover the exact shape of the lateral and the posterior gill; and the buccal appendages can be examined generally only by dissection of the head-cavity, in which they are retracted. Added to this the excessive smallness of some species (not yet 2 mm.), one can understand the difficulty with which the systematic classification of *Pneumonoderma* is connected.

1. *Pneumonoderma peroni* (Lamarck).

1815. *Aegle cucullata* Oken, Lehrbuch der Zoologie, Bd. I, p. 327.
1819. *Pneumodermon peroni* Lamarck, Histoire naturelle des Animaux sans Vertèbres, vol. VI, p. 294.
1887. *Pneumoderma peroni* Fischer, Manuel de Conchyliologie, p. 423.
1887. *Pneumonoderma peroni* Pelseneer, Challenger Rep. LVIII, p. 29, pl. II, fig. 2.

Living animal:
Stat. 109. Pulu Tongkil, Sulu Archipelago. 1 spec.

Only one specimen was caught during the whole cruise of the expedition. It is very contracted; the skin is plicated in large folds and of a greyish colour. In the shape of the gills, and in the disposition of the acetabuliferous appendages, the specimen entirely agrees with the descriptions of Boas and Pelseneer. The length is only 8 mm.

*2. *Pneumonoderma mediterraneum* (van Beneden).

1838. *Pneumodermon mediterraneum* van Beneden, Note sur une nouvelle espèce de Pneumoderme, Mém. Acad. Sci. Brux., vol. XI, p. 13, pl. III, figs. 1—2.
1852. *Pneumodermon peronii (part.)* Souleyet, Voyage de la Bonite, vol. II, p. 274, pl. XIV, figs. 13, 14, 16.
1852. ? *Pneumodermon peronii (part.)* Rang, Histoire naturelle des Mollusques Ptéropodes, pl. XI, figs. 14—19.
1855. *Pneumodermon mediterraneum* Gegenbaur, Untersuch. über Pterop. u. Heterop. p. 213.
1859. *Spongiobranchea australis (part.)* Chenu, Manuel de Conchyliologie, vol. I, p. 116, fig. 509.
1873. *Pneumodermon peronii* Costa, Pteropodi della Fauna di Napoli, p. 22, pl. V, fig. 1—3.
1886. *Pneumodermon macrocotylum* Boas, Spolia atlantica, Bidrag til Pteropodernes Morfologi, etc., K. dansk. Vidensk. Selsk. Skr., 6 Raekke, Bd. IV, p. 152.
1886. *Pneumodermon andebardi* Locard, Prodrome de la Malacologie française, Mollusques marins, p. 19.
1887. *Pneumoderma mediterraneum* Fischer, Manuel de Conchyliologie, p. 423.
1887. *Pneumonoderma mediterraneum* Pelseneer, Chall. Rep. LVIII, p. 26, pl. I, fig. 8. pl. II, fig. 1.

According to Boas, this species has been caught in the Indian Ocean (5° 24′ S., 87° 56′ E. and 10° S., 104° E.) and in the China Sea (16° N., 115° 20′ E.).

MUNTHE recorded[1]) it (also under the name of *Pneumodermon macrocotylum*) from "Javasjön" (von SCHÉELE, 1885). Notwithstanding its occurrence in the East-Indian Archipelago has been ascertained, the Siboga Expedition did not succeed in collecting it.

Many authors have confounded this species with the foregoing one. Indeed, the confusion in the exact discrimination of *Pn. peroni*, *mediterraneum* and *violaceum* existed up to the time of BOAS and PELSENEER.

3. *Pneumonoderma heterocotylum* n. sp. (Pl. V, figs. 118—119).

Stat. 143. 1°4'.5 S., 127°52'.6 E. 1 spec.

Body: Strongly contracted; it seems, however, rather short. Foot of moderate length.

Lateral gill: short, with fringed lateral somatic crest.

Posterior gill: dorsal and ventral side of the quadrangular crest fringed; radiating crests well developed, each of them bearing on either side five or six fringes, which are subdivided.

Buccal appendages: small with a great many suckers, distributed in the following manner: on either side of the base is situated a bundle consisting of about seventy-five very small suckers. In the middle of the acetabuliferous appendage about thirty suckers on very long peduncles are inserted. The shape of these suckers is very peculiar, as they are much elongated, with thin walls. This whole group somewhat resembles a colony of *Vorticella* or *Epistylis*.

Hook-sacs: strongly developed, the inner sac reaches only half the length of the outer one. About twenty strong hooks, strongly bent.

Radula: not investigated.

Colour: yellowish, head dark (spirit-specimen).

Length: 5 mm.

4. *Pneumonoderma pygmaeum* n. sp. (Pl. V, figs. 120—122).

Living animals:
Stat. 141. 1°0'.4 S., 127°25'.3 E. 1 spec. (young).
Stat. 144. Damar Island. 1 spec.
Stat. 165. Daram Island. 1 spec.

Body: short. Foot rather large, not tapering.

Lateral gill: very small, with fringed lateral somatic crests.

Posterior gill: Dorsal and ventral side of the quadrangular crest fringed; each radiating crest bears on its median side two very small fringes, not subdivided.

Buccal appendages: short with about eight suckers; the size of which does not increase from the base to the distal extremity. It is very difficult, even in microscopical examination, to make out the exact number of the suckers, the whole animal scarcely measuring 3 mm.

Hook-sacs: very much developed, extending as far as the posterior extremity of the body. About forty large hooks in each sac.

1) Pteropoder i Ups. Univ. Zool. Mus., Bih. till K. Svensk. Vet. Akad. Handl., Bd. 13, afd. IV, n° 2, p. 32.

Radula: not investigated.

Colour: as the foregoing species.

Length: the largest specimen measured 3 mm.

Remark: The specimen of Stat. 141 shows round its aboral pole a thickened white margin, indicating a posterior ciliated ring. The fringes on the radiating crests of the posterior gill are not formed yet. As the buccal appendages of this specimen exhibit the same number of suckers as those of the two other specimens, I think this larval form may be identical with them.

Perhaps two other larvae from Stat. 165 may be assigned to this species. The length is 2 mm. The foot is smaller, more pointed. Gills are wanting, but some traces of two ciliated rings are visible. First I regarded these small specimens as some *Spongiobranchaea*, but this view is contrary to the form of the acetabuliferous appendages (as in *Pn. pygmaeum*), and also to the rather strong development of the hook-sacs which contain many long, slender hooks. At any rate these specimens (fig. 123) are larvae of a *Pneumonoderma*.

In the literature two species have been described as belonging to *Pneumonoderma*; but these descriptions are very insufficient. We may, however, draw attention to these forms, as they were obtained in the harbour of Amboina.

One of them, "*Pneumodermon ruber*" Quoy et Gaimard [1]) may be a *Clionopsis* as Boas thought [2]); but the presence of a lateral gill speaks against this opinion. As "varieté" of this species Quoy and Gaimard described [3]) some forms which are very likely *Pneumonoderma*, but about which nothing can be decided.

"*Pneumodermon pellucidus*" of the same zoologists [4]) seems to be a *Clionopsis* [5]); but here too a lateral gill is figured. Its systematic position must therefore remain uncertain.

It is very unfortunate that the type specimens of these interesting forms are lost, so that any discussion about them is nothing but conjecture.

Anatomical Remarks.

The anatomy of the Pneumonodermatidae has been amply studied by Pelseneer [6]) whose, very accurate researches will be the base of our knowledge with regard to the anatomy of the whole family, and, indeed, of all the Gymnosomata.

I had only little material for examination, viz. some specimens of *Pneumonoderma mediterraneum* from Naples (kindly presented by Dr. Nierstrasz), of *Pn. peroni* (Leyden Museum), of *Pn. violaceum* (Amsterdam Museum), and of *Spongiobranchaea australis* (Utrecht Zoological Museum). As only the representatives of the first named species were sufficiently preserved, I have studied those particularly.

It seems quite unnecessary to me to enlarge upon the researches of previous authors

1) Voyage de l'Astrolabe, vol. II, p. 389, pl. 20, figs. 19—20.
2) Spolia Atlantica. p. 171.
3) Op s. cit., p. 390, pl. 20, figs. 21—24.
4) Op s. cit., p. 390, pl. 28, fig. 25.
5) This opinion has been expressed by Boas, Spolia atlantica p. 171.
6) Challenger Rep. LXVI, p. 38—45.

(CUVIER, VAN BENEDEN, SOULEYET and GEGENBAUR), as PELSENEER already gave a criticism about them. For conciseness' sake, I believe it will be better to omit the facts, already known; and so I shall confine myself to a few remarks on the nervous system, in which I do not agree with PELSENEER's description [1]).

The nervous system of the Pneumonodermatidae is chiefly characterised by:

1° the rather long connectives, the result of which is that the various ganglia are distinct, and not fused together.

2° the asymmetry of the visceral ganglia (the right is the smaller one), also expressed in the nerves proceeding from them.

3° the second anterior pedal commissure.

4° anastomosing nerves.

I. The cerebral ganglia are rounded in *Pneumonoderma* (Pl. V, fig. 124, *c*), transversely elongated with distinct commissure in *Spongiobranchaea*, quite as PELSENEER already affirmed.

The connectives by which they are connected with other ganglia have been exactly described by PELSENEER; in my figure the buccal connectives are not indicated, in order to avoid complication. The cerebro-pedal (*a*), and the cerebro-pleural connectives (*b*) are, however, visible.

A large number of nerves issue from the cerebral ganglia. First the posterior tentacle is innervated by two nerves, the lateral and posterior of which (1) is the optic nerve, exhibiting an elongated ganglionic swelling at its base. The second nerve, more medial and anterior (2) is the olfactory nerve. Both these nerves terminate in ganglionic swellings, almost juxta-posed, and a little before these ends an anastomosis comes between them, which shows equally an elongated enlargement. SOULEYET whose figures [2]) are by far the best among all those of former researches, has not seen this anastomosis, but it was discovered by BOAS [3]).

Ventrally to the origin of the optic nerve a slender nerve (3) passes to the otocyst. This innervation was seen by PELSENEER [4]) in *Spongiobranchaea*.

From the anterior part of the cerebral ganglia arise:

1° a rather strong nerve (4) to the labial tentacle. In *Spongiobranchaea*, which has, as one knows, the anterior tentacles well developed, the innervating nerve is stronger, conformable to this circumstance.

2° a complex of three nerves (5—7), the function of which I could not clearly make out. This complex, however, innervates (according to PELSENEER) the proboscis, the lips and the buccal appendages. A common trunk from which two or perhaps the three nerves arise, I could not observe. PELSENEER declares that the nerve to the anterior tentacle proceeds from a common trunk with another nerve to the buccal appendages, but I must deny the truth of this, also with respect to SOULEYET's statement [5]); besides, these two authors have not seen one of the two nerves (from the anterior side of the cerebral ganglia) which arise near the median line.

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1) Op. cit., p. 41—45, pl. IV, fig. 9, pl. V, figs. 1, 3.
1) Voyage de la Bonite, vol. II, p. 268, pl. XV, figs. 29, 30, 32, 34, 35.
3) Spolia atlantica.
4) Op. cit., p. 42, pl. V, fig. 3.
5) Op. s. c., p. 268, pl. XV, figs. 30, 33.

II. The buccal ganglia are juxta-posed, but yet distinct and not fused together as VAN BENEDEN [1]) pretends. As to their exact shape and the nerves I may refer to SOULEYET [2]) and PELSENEER [3]).

III. The pedal ganglia have been accurately described by PELSENEER; I have only to remark that in *Pneumonoderma* and *Spongiobranchaea* the anterior pedal commissure (Pl. V, fig. 125, *ap.*) is rather long and bent into a sharp angle.

Here too many nerves may be distinguished (fig. 125).

From the anterior side of each pedal ganglion arises a strong nerve (8), ramifying into the foot. PELSENEER has seen two nerves, somewhat smaller, the lateral of which innervates the fins, the median the foot.

From the lateral side, a little more ventrally two nerves proceed (9, 10). The lateral nerve anastomoses with a branch of the median one; this fact seems not to have been observed yet.

A little posterior to these nerves the rather strong cerebro-pedal connective (*a*) branches off.

From the posterior side of each ganglion, again two nerves issue (11, 12) which pass to the fins; the lateral nerve soon divides into three, one of which is connected with the median by an anastomosis. PELSENEER notes three nerves, the outer of which anastomoses with a nerve of the pleural ganglion; this anastomosis is also shown by SOULEYET. Perhaps it has escaped my notice, but at any rate the anastomosis between the two pedal nerves has been mentioned by SOULEYET [4]) only. According to PELSENEER, the posterior pedal nerves innervate the cervical region; I believe, however, that they pass to the fins.

A pleuro-pedal connective is not visible externally, as the two ganglia are placed very close together.

IV. The pleural ganglia are the smallest of all and almost circular. A strong connective goes from the posterior side to the visceral ganglia (fig. 124, *plv.*), while from the anterior dorsal side the cerebro-pedal connective proceeds (*b*). At the point of origin of this connective two nerves arise (13, 14), innervating the neck. PELSENEER has only seen the outer nerve; I have already told, that the anastomosis, mentioned by him, with a pedal nerve, has not been observed by me.

V. The visceral ganglia (fig. 124, *v*) are remarkable by their asymmetry, the left being the larger. Just where the connective to the pleural ganglia arises, three nerves (15, 16, 17) originate, supplying the visceral sac; a branch of the right lateral nerve innervates the osphradium. From the left visceral ganglion (and not from the right as PELSENEER says, through a slip of the pen) two nerves pass to the viscera (18, 19). PELSENEER records only one visceral nerve from each ganglion to the envelopment of the body; besides, these nerves arise, according to him, from the ganglion itself, and not from the transition into the connective.

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1) Recherches anatomiques sur le *Pneumodermon violaceum* d'Orb., Mém. Acad. Sci. Brux., vol. XI, p. 46, pl. I, fig. 3.
2) Op. s. c., p. 269, pl. XV, figs. 31, 33, 38.
3) Op. s. c., p. 44—45.
4) Op. s. c., pl. XV, fig. 37.

Finally I wish to remark, that the absence of well-preserved material may be my only apology for the insufficient manner in which I could trace out the innervation of the various organs. As to the ganglia and the nerves arising from them, I can, however, answer for the accuracy of my description.

When nothing else is noticed, the species studied is *Pneumonoderma mediterraneum*.

Family II. Clionopsidae.

1855. *Clioidea (part.)* Gegenbaur, Untersuchungen über Pteropoden und Heteropoden, p. 212.
1859. *Pneumodermonidae (part.)* H. and A. Adams, The Genera of recent Mollusca, vol. II, p. 613.
1862. *Clionidae (part.)* Bronn, Die Klassen und Ordnungen des Thierreichs, Bd. III (2), p. 645.
1863. *Clionacea (part.)* Troschel, Das Gebiss der Schnecken, Bd. I, p. 54.
1873. *Clinopsidei* Costa, Pteropodi della Fauna di Napoli, p. 24.
1887. *Clionopsidae* Pelseneer, Chall. Rep. LVIII, p. 33.
1889. *Cliopsidae* Dall, in: Bullet. U. S. Nat. Mus., n^0 37, p. 82.

The characters of this family consist chiefly in a very long retractile proboscis, without buccal appendages, a quadrangular posterior gill, while the lateral one has disappeared.

A specimen, caught by the Siboga Expedition did not exhibit, however, any trace of a posterior gill.

Only one genus is known.

Clionopsis Troschel.

1854. *Cliopsis* Troschel, Beiträge zur Kenntniss der Pteropoden, Arch. f. Naturgesch., Jahrg. XX (1), p. 222.
1855. *Clio (part.)* Gegenbaur, Untersuchungen über Pteropoden und Heteropoden, p. 212.
1862. *Clionopsis* Bronn, Die Klassen und Ordnungen des Thierreichs, Bd. III (2), p. 645.

Up to the time of Boas only one species was known. Boas himself described a second species; and a third one was procured by the Challenger Expedition. I shall describe a new species further on.

*1. *Clionopsis grandis* Boas.

1885. *Pneumodermon peronii* Verrill, Third Catalogue of the Mollusca, added to the Fauna of the New England Coast, Transact. connect. Ac. Arts and Sci., vol. VI, p. 431.
1886. *Cliopsis grandis* Boas, Spolia atlantica, K. dansk. Vidensk. Selsk. Skriv., 6 Raekke, Bd. IV, p. 170.
1888. *Clionopsis grandis* Pelseneer, Chall. Rep. LVIII, p. 136, pl. II, figs. 7—8.

According to Boas, this species has been recorded twice from the China Sea (2° 4′ N., 106° 50′ E. and 3° 30′ N., 107° E.). Very probably it occurs in the East-Indian Archipelago, but it has not been found by the Siboga Expedition.

2. *Clionopsis microcephalus* n. sp. (Pl. V, figs. 126—128).

Living animal:

Stat. 259. 5° 29'.2 S., 132° 52'.5 E. 1 spec.

Body: elongated, truncated at the posterior end. Skin without pigment, transparent, with a great many small, brown glands, which are placed in groups of three or four together. Two systems of crossing lines (muscular fibres) are visible on some parts of the skin. Visceral nucleus extending to the posterior extremity. The connective tissue, consisting of branched cells, between the nucleus and the skin especially well developed. The body is somewhat compressed, showing a constriction in the anterior part, beneath the fins. I have seen no dorsal spot.

Head: small; neck short.

Foot: the anterior lobes are thick, and muscular; posterior lobe absent, as in the other species of the genus. Tubercle well developed, oval, consisting of five or six lamellae, longitudinally placed. Anterior lobes terminating distally in an acute angle.

Fins: small, rounded (they are strongly contracted in the single specimen collected).

Posterior gill: wholly absent; at the aboral pole, however, of the body at the place of the gill, the genital gland is situated, at the outside of the body, somewhat turned to the right. It consists of numerous rounded follicles which in microscopical examination show some ova with a very large nucleus, and a great many rounded cells, imbedded in fibrillar connective tissue. A thin, brownish-coloured efferent duct arises from the gland towards the accessory genital glands, situated ventrally. The curious arrangement of the genital gland at the outside of the body seems perhaps abnormal (due to fixation?), but it is more probable that it is the normal position in the living animal, as I could not observe any rupture in the body-wall, and the internal organs did not exhibit any displacement.

Hook-sacs: very shallow, each with about twenty hooks, bunch-like arranged.

Radula: the formula is 4.1.4. The median tooth is tricuspid, as in other Clionopsidae, but at both cornua of the semi-lunar tooth a small projecture may be seen (fig. 128). The lateral teeth are well developed, with broad base and strong beak, slightly bent at the extremity.

Proboscis: very long, laid in wide windings, when invaginated; about as long as the animal itself. It occupies the whole anterior portion of the visceral mass, while the posterior part is filled up by the stomach and the liver.

Colour: yellowish, nucleus visible as a dark, thick bar (spirit-specimen).

Length: 15 mm.

Remarks: The general form of the body, the transparency of the skin with its systems of crossing lines, the absence of a gill whose function seems to be adopted by the genital gland, the longitudinal lamellae in the tubercle between the anterior lobes of the foot, the small number of hooks in the hook-sacs, and the formula of the radula — alle these peculiarities are sufficient to take it for granted, that the specimen of the Siboga is a new species. It seems even admissible to regard it as the representative of a new genus (characterised by the absence of a gill, and the conformation of the genital gland), but as I could study only this

single specimen, I do not venture to erect a new genus on such negative and perhaps abnormal characters.

Pelagia alba Qoy and Gaimard [1]) has some resemblance with this form, but differs from it in the great development of the head. The naturalists of the Astrolabe collected this *Pelagia* in the harbour of Amboina.

Anatomical Notes.

Unfortunately I could not obtain a single specimen for examination; and the wish to preserve the specimen of the Siboga Expedition has prevented me from dissecting it. To the above-mentioned notes about this specimen I may add, that the visceral mass is enveloped by a rather thick whitish membrane, with the same peculiar numerous openings as has been recorded in *Cymbuliopsis* and *Gleba*; probably, respiration takes place by means of these openings. The anus opens at the right side beneath the fin, and the heart is placed far back. These facts comprise in a few words all I could discover about the anatomy.

Family III. Notobranchaeidae.

1886. *Notobranchaeidae* Pelseneer, Description d'un nouveau genre de Ptéropode Gymnosome, Bullet. Sci. Dép. Nord, p. 224.

As some specimens of the genus *Notobranchaea* have been found in the Siboga-collection, I am able to complete the description, given by Pelseneer.

Body: contracted and pointed at the posterior extremity; visceral mass not reaching the aboral pole. No dorsal spot. Head broad and swollen, distinctly separated from the short neck.

Foot: posterior lobe tapering; anterior lobes terminating distally in an acute angle; a small tubercle between them.

Fins: large, rounded.

Posterior gill: three longitudinal crests, meeting at the posterior extremity of the body, and extending over the posterior third of its length; one crest is median and dorsal, and bears fringes (in the adult specimen at least), the lateral crests (right and left) are simple. A lateral gill is absent.

Buccal appendages: short, thick buccal cones of the same external appearance and of nearly the same structure as in *Clione*.

Radula: strongly developed, with many teeth in a transverse series, but without a median tooth.

Hook-sacs: short and shallow, with a few hooks, arranged in a bunch at each side of the radula.

Jaw: absent.

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1) Voyage de l'Astrolabe, vol. II, p. 392, pl. 28, figs. 7—9.

Only one genus is known.

Notobranchaea Pelseneer.

1825. ? *Clio (part.)* Rang, Description d'un nouveau genre des Ptéropodes et de deux espèces nouvelles du genre Clio, Ann. d. Sc. Nat., sér. I, vol. V, p. 286.
1863. *Clio (part.)* Macdonald, On the Zoological Characters of the living *Clio caudata,* Trans. Roy. Soc. Edinb., vol. XXIII, p. 186.
1886. *Notobranchaea* Pelseneer, Description d'un nouveau genre de Ptéropode Gymnosome, Bullet. Sci. Dép. Nord, p. 224.

This genus was established by Pelseneer, but the little material at his disposal did not enable him to give a complete diagnosis.

The characters of this genus are the following, according to my own researches:

Buccal cones: two pair of short cephaloconi, disposed in the same manner as in *Clione*, viz. inserted on the wall of the buccal cavity, at the outside of the "false lips", while a hood circumscribes an opening, corresponding with the true buccal aperture in the Pneumonodermatidae and Clionopsidae. Pelseneer ascribes to *Notobranchaea* only one pair of cephaloconi, but I have seen two pair of them in the same species that was studied by him. In this respect Macdonald is right whose description, for the rest, is too obscure and too short as to recognize with certainty the species to which his "trigonal tailed *Clio*" belongs.

Posterior gill: the fringed dorsal crest is a very complicated winding fold of the skin. I have seen a larva (most probably belonging to the same genus) in which the three crests consist of a great many dermal glands closely grouped together, and in which a gill properly so called is not present. I shall refer to this larva again.

Radula: without median tooth, quite the same as has been described above for the family.

Hook-sacs: short, with a few hooks.

The family of the Notobranchaeidae shows very great resemblance with the Clionidae, and it may be expected that when more species will be discovered, these two groups will have to be united to a single family.

Of the two species hitherto described, one was found by the Siboga.

1. *Notobranchaea inopinata* Pelseneer. (Pl. V, figs. 129—135).

1887. *Notobranchaea inopinata* Pelseneer, Chall. Rep., LVIII, p. 40, pl. III, figs. 5—6.

Stat. 144. Damar Island. 3 spec.

Body: ovate, posterior extremity much contracted in the preserved specimens. Head broad, bilobated, distinctly separated from the neck. Pigment in one specimen chiefly distributed on the right side; in the two other specimens it is entirely absent.

Foot: the anterior lobes (fig. 133) are rather broad, free in their posterior half. The tubercle is rounded. Posterior lobe short, but pointed with a longitudinal ridge.

Posterior gill: consisting of a much wound fold, without real fringes (fig. 134).

Buccal appendages: two pair of buccal cones (fig. 131—132).

Labial tentacles: small, situated about as much dorsally as ventrally.

Radula: the formula is 8.0.8 (fig. 135).

Length: the pigmented specimen measures 6 mm., the two other specimens are 5 mm.

Colour: the pigmented specimen is yellow; the other specimens are greyish (spirit-preservation).

Observation: I have tried to give a sufficient description of the Siboga-specimens, in which I could not observe any specific difference from the *Notobranchaea inopinata* of PELSENEER. This species was found by the Challenger, east of Japan (35° 29′ N., 179° 50′ W.) and afterwards it has been recorded [1]) from Port Jackson Heads, New South Wales.

To the Notobranchaeidae, and probably to *Notobranchaea* a curious larva must be referred (Pl. V, figs. 136—138). This larva was found at Stat. 36 (7° 38′ S., 117° 31′ E.).

The length is only 2 mm. A great many glands are scattered all over the body, but at the place, where the three crests of the posterior gill are situated in adult specimens, the glands are very closely grouped together, and this accumulation also occurs at the posterior extremity (fig. 138). The two posterior ciliated rings are still discernible as thin white lines. The whole body is more pointed, the visceral sac does not occupy the posterior third of the body. The fins are rounded and broad; the anterior lobes of the foot are free for half their length, and the posterior lobe is pointed — quite as in *Notobranchaea inopinata*. The neck is shorter and broader (perhaps due to stronger contraction). The nuchal tentacles are placed far back. The proboscis is somewhat evaginated and shows also two shallow hook-sacs, with bunches of hooks By clearing the specimen in glycerin, I could observe two pair of buccal cones. The skin is without pigment and of a grey colour (alcoholic preservation).

Anatomical Remarks.

The anatomy of *Notobranchaea* has never been studied until now. Though I could not push my researches so far as to give a complete anatomical description, I shall try to indicate a few things which I have observed.

The external appearance of the animal has been already described.

The proboscis possesses false "lips" as in *Clione*, the buccal appendages being therefore inserted around the secundary mouth. The cephaloconi number two pairs. Their internal structure I could unfortunately not make out, as the dissected specimens did not clearly show delicate histological details. I could only see on transverse sections: (1) a middle muscular region, consisting of an exterior layer with annular fibres and an interior one with longitudinal fibres, (2) an internal region formed of glandular cells, while the (3) epithelial investment nothwithstanding I took much care to investigate it, has remained indistinct. Probably, the

1) BRAZIER, Australian Museum Catalogue (1892), n° 15, Prt. II, Pteropoda, p. 42.

structure of the cones will not differ greatly from that of the cephaloconi in *Clione*, as described by PELSENEER [1]).

The radula is strongly developed, without median tooth. The hook-sacs are short; each hook (one cell) bears a large nucleus at its base, while the horny layer is only found at the free periphery of the tapering cell.

Very remarkable are some bladder-like organs around the oesophagus, and reaching as far as the stomach. Though these bladders open sometimes in each other, a communication with the digestrive tract or with any other organ does not exist at all. They are therefore similar to the "Schlundblasen", noticed by MEISENHEIMER [2]) in *Pteroceanis*, and about which an extensive description will soon be published.

The structure of these sacs is the following (Pl. V, fig. 139): a layer of epithelial cells is found peripherically (*a*) with very flat, small nuclei, and at the inside of this layer, a region of glandular cells (*b*) with large nuclei and with prolongations into a reticulated network of branched cells (*c*) with very small nuclei. The inner part of the sac is probably filled with secretion of the glands. It may be noted, that the epithelial layer at the outside does not always occur.

I have seen no salivary glands.

As to the rest of the digestive tract, I have observed no differences from that of other Gymnosomata. The ciliated villi of the oesophagus end into the stomach, which is rather wide and wholly unarmed. The intestine is short and goes directly upwards, opening beneath the right fin.

The shape of the generative organs too is quite similar to that of other Gymnosomata (fig. 140). The gonad (*g*) is rounded and occupies the posterior part of the visceral mass. This gland consists of the same hermaphrodite lobules as in the preceding families. A thin efferent duct (*d*), soon enlarging in its course, arises from the gonad and reaches the accessory genital glands. The albuminiparous (*b*) and muciparous glands (*a*) have a different aspect on their surface, the plicae of the former being smaller and more numerous. A "vagina" (GEGENBAUR) proceeds from the dorsal surface (*v*) of the accessory genital glands. The penis, coiled up in the head cavity, exhibits on its surface (when invaginated) at the right side, a broad, winding band, consisting of very high epithelial cells (fig. 141).

The disposition of the ganglia in the central nervous system scarcely presents anything remarkable, as far as I could perceive. The cerebral ganglia are closely placed together above the oesophagus, but show a distinct commissure. The ganglia below the oesophagus are arranged in the same manner as in the Pneumonodermatidae; the visceral ganglia too are asymmetrical, the left being the larger. From this ganglion issue two nerves, the right visceral ganglion is destitute of such nerves.

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1) The cephalic appendages of the Gymnosomatous Pteropoda and especially of Clione. Quarterly Journal Micr. Sc., vol. XXV (1885), p. 491—509, pl. XXXV.

2) Über eine neue Familie der gymnosomen Pteropoden aus dem Material der Deutschen Tiefsee-Expedition (Pteroceaniden), Zool. Anz., Jahrg. XXVI, p. 96.

Family IV. Clionidae.

1840. *Clionidae* Gray, Synopsis of the contents of the British Museum, p. 86.
1846. *Clionoidae (part.)* Agassiz, Nomenclator Zoologicus, Index, p. 90.
1850. *Clioneidae* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 35.
1853. *Pneumodermidae (part.)* d'Orbigny, in: Ramon de la Sagra, Histoire physique, politique et naturelle de l'île de Cuba, Mollusques, vol. I, p. 70.
1855. *Clioidea (part.)* Gegenbaur, Untersuchungen über Pteropoden und Heteropoden, p. 212.
1856. *Cliidae (part.)* Woodward, A Manual of the Mollusca, p. 208.
1863. *Clionacea (part.)* Troschel, Das Gebiss der Schnecken, Bd. I, p. 54.

As one knows, this family is characterised by the much elongated body, the absence of a gill and by the cephaloconi, inserted at the outside of false lips. It is very closely related to the family of the Notobranchaeidae, but differs from it in the strongly pronounced tapering of the body, the entire absence of a gill and by a median tooth in the radula.

The foot of the Clionidae resembles much that of the Notobranchaeidae: the anterior lobes have nearly the same shape, and no tubercle is found between them. The posterior lobe of the foot, however, is still more reduced, and, as we shall see further on, it is even entirely absent in the new genus *Paraclione*.

Great confusion has existed for a long time in the systematic treatment of this family. A rather large number of species, belonging to this family, and having been described nearly always under the name of *Clio*, are insufficiently characterised, and the figures representing them are generally incomplete. Up to now, however, only one species is well known, viz. *Clione limacina*, and it would be very interesting to obtain further information on forms previously described, but never found again. I may, for the rest, refer to Pelseneer [1]) who gave a critical systematical synopsis of this family.

Now, to the genus *Clione*, I can add a new genus, procured by the Siboga Expedition.

Clione Pallas.

1773. *Clio (part.)* Phipps, A Voyage towards the North Pole, p. 195.
1774. *Clione* Pallas, Spicilegia zoologica, fasc. X, p. 28.
1776. *Clio* O. F. Müller, Faunae danicae prodromus, p. 226.
1825. *Cliodita (part.)* Qoy et Gaimard, Description de cinq genres de Mollusques, Ann. d. Sci. Nat. sér. I, vol. V, p. 74.
1840. *Spongiobranchea (part.)* d'Orbigny, Voyage dans l'Amérique méridionale, vol. V, p. 132.
1852. *Clio (part.)* Rang, Histoire naturelle des Mollusques Ptéropodes, p. 77.
1855. *Clio (part.)* Gegenbaur, Untersuchungen über Pteropoden und Heteropoden, p. 212.
1855. *Clio* Auctorum.

In *Clione* the body is much elongated, terminating into a rather thin point. The buccal cones number from one to three pairs, the labial tentacles are well developed, and the posterior

1) Chall. Rep. LVIII, p. 41—51.

lobe of the foot, though much reduced, is yet present. The fins are pointed, the proximal angle extending farther than the distal one.

Three species may be distinguished. The only specimen in the Siboga-material belongs to a new species, a description of which follows here.

1. *Clione punctata* n. sp. (Pl. V, fig. 142).

Stat. 165. Daram Island. 1 spec.

Body: pointed at the back, not much elongated.

Head: depressed, rather broad; neck very short.

Foot: anterior lobes thick, semi-lunar, attached throughout nearly their whole length, and terminating into an obtuse angle. Posterior lobe very short, pointed.

Fins: short and broad (but much contracted in the specimen).

Buccal appendages: there is only one pair of buccal cones, disposed in the usual manner. Their shape is cylindrical, not conical as in *Clione limacina*.

Radula and Hook-sacs: not investigated.

Colour: the skin is transparent and quite colourless; the visceral mass exhibits a pale yellowish colour, and so does the head, though here the colour is somewhat darker. The fins are whitish. Very remarkable are chromatophors, scattered all over the visceral mass and the head, even over the cephaloconi. The shape of these chromatophors (fig. 143) varies very much; they are black, and, as I have convinced myself, they are not situated in the skin itself, but beneath it.

The specimen has been preserved in formol 4%.

Length: 4 mm.

Remarks: As I had only one specimen at my disposal, I have not ventured to investigate the radula and hook-sacs, as dissection would have damaged the animal seriously. I, therefore, must restrict myself to the indications noted above, in order to distinguish *Clione punctata* from other species of this genus. The presence of only one pair of buccal cones, and the occurrence of chromatophors has not yet been recorded in *Clione*. The skin which is very thin and wholly transparent, consists of a pavement epithelium of polygonal cells with small nuclei, and of a small number of unicellular glands; muscular fibres run beneath this epithelium.

Quoy and Gaimard recorded a new species of "*Clio*" from the harbour of Amboina. This form was called by them *Clio pyramidalis* [1]), but description and figure are very obscure. The fins are "ovalaires, largement fixées au corps". I should be inclined to think, that we have to do with some *Aplysia* or *Notarchus*. At any rate I wanted to draw the attention to this form.

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1) Voyage de l'Astrolabe, vol. II, p. 371, pl. 27, figs. 37.

Anatomical Remarks.

The anatomy of this genus has been studied by CUVIER [1]), ESCHRICHT [2]), SOULEYET [3]), WAGNER [4]), PELSENEER [5]) and SCHALFEJEFF [6]). I have thought it better to give a few notes with respect to the central nervous system about which PELSENEER gave a most detailed description. As I differ from him in a few points, I cannot let them pass in silence. I have examined some specimens of *Clione limacina* (Leyden Museum).

The central nervous system of *Clione* is constituted like that of the Pneumonodermatidae, viz. the form and disposition of the ganglia is nearly quite the same. In *Clione*, the pleuro-visceral connective is a little shorter, and the pedal ganglia present a long commissure (which, however, does not always occur).

I. The cerebral ganglia (Pl. V, fig. 144) are situated above the oesophagus, and exhibit a distinct commissure. Three pair of connectives issue from them.

A. From the oesophageal surface of each ganglion a thin connective (*bc*) passes to the buccal ganglia.

B. From the lateral side a strong connective (*pc*) goes to the pedal ganglion.

C. A little more distally, nearly parallel to the foregoing one a cerebro-pleural connective (*plc*) is discernible.

The last two connectives are longer than in the Pneumonodermatidae.

From each cerebral ganglion several nerves arise.

From the dorsal part two nerves (1, 2) proceed to the nuchal tentacle. They are the olfactory and the optic nerve, both ending in a swelling. The optic nerve (2) exhibits at its base a ganglionic enlargement, readily visible. An attentive examination shows, that it consists of two elongated swellings (fig. 145), each with a large nucleus. This fact seems not to have been observed before. I could not discover an anastomosis between the two nerves, but such a connection has been mentioned by BOAS [7]), who studied it in *Clione*.

From the lateral side of the cerebral ganglion, a little ventrally, a nerve (fig. 144, 3) passes to the otocyst.

I have seen two large trunks arising from the front part of the cerebral ganglion. The lateral one soon divides into two branches, each of which sends off a slender nerve to the skin (4, 5). The lateral branch (4) innervates the ventral buccal cone; the median (5) goes to the labial tentacle. The median trunk equally divides into two nerves (6, 7),

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1) Mémoire sur le *Clio borealis*. Ann. Mus. d'Hist. Natur. vol. II (1802), p. 242—249.

2) Anatomische Untersuchungen über die *Clione borealis* (1838).

3) Voyage de la Bonite, vol. II, p. 275—288, pl. XV, figs. 1—17.

4) Die Wirbellosen des Weissen Meeres. Bd. I (1885), p. 89—120.

5) The cephalic appendages of the Gymnosomatous Pteropoda, and especially of *Clione*, Quarterly Journ. Micr. Sci. (1885), vol. XXV, p. 491—507, pl. XXXV, and Recherches sur le système nerveux des Ptéropodes, Arch. de Biol., vol. VII, p. 96—101, pl. IV, figs. 1—4.

6) Zur Anatomie der *Clione limacina*, Zool. Anz., Jahrg. XII, p. 188—190.

7) Spolia atlantica, p. 143.

the lateral (6) of which innervates the dorsal buccal cone, while the median (7) supplies the middle cone, and moreover sends off a slender thread to the false "lips".

According to PELSENEER, the dorsal and middle cone are supplied by two nerves, arising from a common median trunk. He speaks of a lateral trunk, innervating the anterior tentacle and the ventral cone; besides there is an anastomosis between the nerves to the ventral and to the middle cone. I could not discover this anastomosis. Finally PELSENEER mentions a lateral slender nerve, rising independently, to the false "lips". In the main points agreeing with him, I cannot, however, entirely share his opinion, as I have explained above (as regards the anastomosis, and the innervation of the "lips").

II. The pedal ganglia have a triangular shape (fig. 146) and present a long and rather thin commissure (*pecd*) between them. In one specimen, however, the ganglia were close together, and so the commissure was short. The very long anterior pedal commissure (*apdc*) issues from the base of the median nerve (8), which proceed from the pedal ganglion, as PELSENEER already remarked. From the proximal surface of each ganglion one nerve (9) arises, supplying the fins, and another nerve (10) innervating the lobes of the foot, as the median nerve (8) does too.

From the lateral part a cervical nerve (11) forms a plexus with another nerve (12) from the pleural ganglion (fig. 144) I have already told that I could not observe this cervical plexus in *Pneumonoderma* in which it is said to exist as well.

Finally, from the ventral surface of the ganglion and thus on dorsal view concealed for the greater part, a strong nerve issues (fig. 146, 13). I could not clearly make out its destination, but as this nerve passes ventrally to the visceral ganglion, it seems as if it proceeds from this ganglion. Probably it is this nerve which WAGNER [1]) took for a visceral one, when he says, that the lateral nerve of the left visceral ganglion in some cases arises from the pedal ganglion.

The otocysts are placed in the usual manner.

III. The pleural ganglia are in apparent juxtaposition to the pedal ganglia, but a connective between these ganglia really exists. The only nerve passing from the pleural ganglion (fig. 144, 12) anastomoses with a pedal nerve and has been mentioned already.

III. The pleuro-visceral connective (fig. 144, *plv*) is shorter than in *Pneumonoderma*. The visceral ganglia show a scarcely indicated asymmetry, which is distinctly pronounced in the nerves. From each ganglion a strong nerve (14) arises; besides there are two visceral nerves from the left ganglion (15, 16). The lateral of these nerves (16) is stronger than the median (15), whose origin is so close to the separation between the ganglia, that a slight mistake as WAGNER has committed [2]), who figured this nerve as having its origin between the two ganglia, may be readily for given.

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1) Die Wirbellosen des Weissen Meeres, Bd. I, p. 100, pl. XI, figs. 4, 11.
2) Op. s. cit., pl. XII, figs. 1, 12.

Paraclione n. g.

Closely resembling *Clione*, but distinguished from it by the absence of the posterior lobe of the foot, and by a rather long spine in the median tooth of the radula [1]).

Description: the body is elongated, but not so much as in *Clione*; terminating into an obtuse point, separated from the rest of the body by a constriction. Visceral mass not extending towards the extremity; between the visceral mass and the skin branched connective tissue is well developed, especially on the right side of the body. Head broad, bilobated, separated from the trunk by a short neck. Anterior lobes of the foot broadly attached; no tubercle between them; posterior lobe quite absent. Fins broad and rounded at their distal extremity. Buccal appendages conical, inserted at the outside of false "lips". Hook-sacs with a few hooks; no jaws. Radula with a median tooth which shows a slender spine, springing from the proximal margin of the tooth, but directed distally.

1. *Paraclione pelseneeri* n. sp. (Pl. V, figs. 147—152).

Stat. 36. 7° 38′ S., 117° 31′ E. 1 spec.
Stat. 213. Saleyer Island. 3 spec.
Stat. 223. 5° 44′.7 S., 126° 27′.3 E. 1 spec.

Body: as described above for the genus. As may be seen from the figures, the shape of the animals differs considerably, but this fact is partly due to contraction, partly to the more or less development of the connective tissue beneath the skin. In one specimen of Stat. 213 (fig. 148) this tissue is especially well developed on the head, which is therefore much larger than in the other specimens. Two specimens of Stat. 213 and one of Stat. 223 (figs. 148, 149) present chromatophors, disposed in the same manner as in *Clione punctata*, the skin itself being therefore quite without pigment and only provided with unicellular mucous glands, chiefly crowding in the neck, and above the cloacal depression. The point in which the body terminates, bears beneath its epithelium on the surface, a rather strong layer of annular muscular fibres, at the inside of which several longitudinal muscles spread over the body-wall. By the layer of annular muscles is the aboral pole more opaque than the rest of the skin.

Foot: the anterior lobes are broadly attached; in the specimen of Stat. 223 (fig. 149) these lobes are a little deformed and curled outwards. They are free for about one half of their length. A posterior lobe is absent.

Fins: rounded at their distal extremity.

Buccal appendages: two pairs, inserted at the outside of false "lips" (fig. 152); the dorsal is smaller than the ventral, but of course I cannot say whether this difference is a specific characteristic or a generic one. As the animals are exceedingly small, it is necessary to make transverse sections through the head, if one intends to examine the disposition of the cephaloconi.

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1) It must be noted, that MACDONALD (Transact. Roy. Soc. Edinb., vol. XXIII (1863), pl. IX, fig. 3, *e*) also represents the radula of "*Clio caudata*" as possessing a median tooth with a long spine. Unfortunately, however, the foot has not been described.

Radula: with a median tooth, which carries a rather long spine, directed distally (fig. 151*A*). The formula is 3 . 1 . 3; the lateral teeth present a slender shape.

Hook-sacs: short, as in *Clione*; the hooks have a broad base, and are bent abruptly at their extremity (fig. 151*B*).

Jaw: absent.

Length: the largest specimen measures 3 mm.

Colour: greyish or yellowish; the chromatophors are black (spirit-preservation).

Remark: though the animals are very small, they are no larvae, as no trace of ciliated rings exists.

Anatomical Remarks.

By making a series of transverse sections through one specimen, I have convinced myself that the anatomy of the only representative of this new genus is very much like that of *Clione*. The digestive tract does not offer anything remarkable. The anus opens at the ventral margin of a cloacal depression; at the dorsal margin the osphradium is situated. The kidney opens immediately beneath this organ. A penis is entirely absent; perhaps this is another peculiarity of the genus. The gonad is situated ventrally to the liver; a thin efferent duct without any perceptible swelling in its course opens into the muciparous and albuminiparous glands, the folds of which consist of a high cylindrical epithelium. A vas deferens with a small hernia at its base, opens beneath the distal margin of the right fin. The gonad itself is made up of numerous rounded cells, consisting chiefly of a nucleus and probably spermatids. Some ova with very large nucleus are found at the periphery.

The central nervous system is arranged in the same manner as in *Clione*. The pedal ganglia possess a long commissure too.

Family V. Halopsychidae.

1850. *Cymbuliadae (part.)* Gray, Catalogue of the Mollusca in the collection of the British Museum, prt. II, Pteropoda, p. 24.
1856. *Hyaleidae (part.)* Woodward, A Manual of the Mollusca, p. 204.
1859. *Eurybidae* Chenu, Manuel de Conchyliologie, vol. I, p. 115.
1863. *Euribiacea* Troschel, Das Gebiss der Schnecken, Bd. I, p. 54.
1887. *Eurybiidae* Fischer, Manuel de Conchyliologie, p. 426.
1887. *Halopsychidae* Pelseneer, Chall. Rep., LVIII, p. 52.
1887. *Cymbuliidae (part.)* Auctorum.

Among the Gymnosomata the Halopsychidae take an isolated place. Though they are certainly related to the Clionidae, there is a remarkable distance between these families. Indeed, the general aspect of the only representative of the Halopsychidae, sufficiently known, only vaguely suggests the common habitus of the Gymnosomata; and it is only by means of more careful examination, that the general characters can be discovered. One can even

easily understand the mistake of most zoologists (before Boas and Pelseneer) who considered these animals as testaceous, and therefore classed them among the Thecosomata.

As to the characters of the family, I may refer to Boas [1]) and Pelseneer [2]). Some inaccuracies of Boas, who mistook the buccal appendages as most authors did before him, were rectified by Pelseneer. I must, however, protest against one statement of both authors, viz. that the posterior lobe of the foot is separated from the fins, as in all Gymnosomata. I have examined a large number of specimens, but I always found this posterior lobe connected with the fins (Pl. VI, fig. 153, *pl*). In this respect I agree with Huxley [3]) and Souleyet [4]).

Halopsyche Bronn.

1825. *Psyche* Rang, Description d'un nouveau genre de la classe des Ptéropodes, Ann. d. Sc. Nat., sér. 1, vol. V, p. 284.
1827. *Euribia* Rang, Description de deux genres nouveaux, appartenant à la classe des Ptéropodes, Ann. d. Sc. Nat., sér. 1, vol. XII, p. 328.
1832. ? *Cymbulia (part.)* Quoy et Gaimard, Voyage de l'Astrolabe, p. 376.
1856. *Eurybia* Woodward, A Manual of the Mollusca, p. 206.
1862. *Halopsyche* Bronn, Die Klassen und Ordnungen des Thierreichs, Bd. III, p. 645.
1862. *Theceurybia* Bronn, Ibid., p. 645.

From the description and figures of Quoy and Gaimard who described a "*Cymbulia norfolkensis*", it is impossible to decide to which form these indications must be applied. Most probably a species belonging to the genus in question is meant.

At present only one species is sufficiently well known, which has been collected in considerable quantities by the Siboga Expedition. As to the forms *Psyche globulosa* and *Euribia hemispherica*, both described by Rang, we know too little about them as to express any opinion regarding their systematic position, but it would be very interesting to obtain further information, as the fins in these animals attain excessive development.

1. *Halopsyche gaudichaudi* (Souleyet). (Pl. VI, figs. 153—156).

1852. *Euribia gaudichaudii* Souleyet, Voyage de la Bonite, vol. II, p. 253, pl. XIV, figs. 1—6.
1859. *Eurybia gaudichaudi* Macdonald, On the anatomy of *Eurybia gaudichaudi*, Transac. Linn. Soc. Lond., vol. XXII, p. 245, pl. XLIII.
1883. *Theceurybia norfolkensis* Ray Lankester, Mollusca, Encyclop. Brit., 9th Ed., vol. XVI, p. 666, fig. 83.
1886. *Halopsyche gaudichaudii* Boas, Spolia atlantica, Bidrag til Pteropodernes Morfologi etc., K. Dansk. Vidensk. Selsk. Skrift., 6 Raekke, Bd. IV, p. 173, pl. VIII, fig. 119.
1887. *Halopsyche gaudichaudi* Pelseneer, Chall. Rep. LVIII, p. 55, pl. III, figs. 7—9.

Living animals:
Stat. 141. 1° 0′.4 S., 127° 25′.3 E. 28 spec.
Stat. 143. 1° 4′.5 S., 127° 52′.6 E. 3 spec.

1) Spolia atlantica, p. 171—173.
2) Chall. Rep., LVIII, p. 52—53.
3) On the Morphology of the cephalous Mollusca, Philos. Transact. (1853), pl. IV, fig. 3.
4) Voyage de la Bonite, vol. II, pl. XV, fig. 1.

Stat. 148.	0° 17′.6 S., 129° 14′.5 E.	3 spec.
Stat. 157.	0° 32′.9 S., 130° 14′.6 E.	3 spec.
Stat. 172.	Between Gisser and Ceram-Laut.	6 spec.
Stat. 185.	3° 20′ S., 127° 22′.9 E.	9 spec.
Stat. 203.	3° 32′.5 S., 124° 15′.5 E.	18 spec.
Stat. 205.	Lohio Bay, Buton Strait.	1 spec.
Stat. 216.	6° 49′ S., 122° 43′ E.	1 spec.
Stat. 243.	4° 30′.2 S., 129° 25′ E.	2 spec.
Stat. 245.	4° 16′.5 S., 130° 15′.8 E.	2 spec.

This species was found by the Challenger off Mindanao. It seems very common in the East-Indian Archipelago, and by far more numerous than any other Gymnosomatous form.

Anatomical Remarks.

Skin: without pigment, of a yellowish colour. The body-wall is very thick on the trunk, but not on the head. The animal can entirely retract into its tough envelopment; in this case two extensions (dorsal and ventral, of which the dorsal is more developed) cover the head and its cephalic appendages in such a way, as to form a frontal fissure. In this contracted state the animal, indeed, suggests at first sight some *Cymbuliopsis*.

The skin is well provided with dermal glands which are visible, even to the naked eye, as small white spots (in formol-preservation). Transverse sections through the skin show its structure sufficiently (Pl. VI, fig. 154). At the surface is found an epithelium (1) of flat cells with distinct nuclei; on surface view these cells appear to be polygonal. Beneath the epithelium there is a layer (more or less thick) of elastic fibres. In this layer the glands are situated, and they attain a differentiation which is not found in other Gymnosomata, for aught I know. Yet they are all unicellular glands, in which a nucleus is always present. Some of these glands are very small, goblet-shaped (3), while others (4) are larger, more slender and pyriform, the contents of which absorb much colouring matter so as to become diffusedly coloured. The walls of these glands are simply membraneous without distinct structure. Finally a third form is represented by very large glands (2), with a short efferent duct and with granular contents. The walls, when cut tangentially, show striae, (perhaps they are muscular) crossing one another in several directions.

The layer of elastic fibres between which nuclei are scattered, together with the surface epithelium, make up the skin (fig. 154, *a*). Beneath this skin is found the usual layer of branched stellated cells (*b*).

Head: the head is extremely small and difficult to distinguish. On the one hand this is due to the absence of a cephalic hood, on the other to the great development of the cephalic appendages. As to the latter, the great confusion reigning with respect to a right interpretation of buccal appendages and tentacles was not cleared up until Pelseneer came to the fore-ground. I may therefore refer to his paper.

Foot: the foot is somewhat differently shaped from what is usually found in the Gymnosomata. The anterior lobes (fig. 153, *al*) are free for the greater part; the posterior lobe (*pl*) is not separated from the fins, but distinctly attached to it. I have already said, that this statement does not agree with that of Boas or Pelseneer.

Fins: these locomotory organs are also a little deviating from the usual type. They are narrow at their base, enlarged at their distal extremity, which is membraneous, especially in the middle, and exhibits a sinuosity (fig. 153, *f*).

Digestive tract: The mouth, bordered by false "lips", opens immediately behind (dorsally to) the anterior lobes of the foot. At the sides of the lips the buccal appendages are inserted. These appendages are long, flattened and very contractible. I have tried to examine their histological structure, but as neither transverse or longitudinal sections (10 or 5 $\mu\mu$.), nor staining in toto and mounting, has given me sufficient results, I think it better to pass over this structure in silence, rather than to speak of something, about which I could not obtain absolute certainty as yet.

A protrusile proboscis is quite absent. The oesophagus has a narrow lumen, as its walls are laid in large folds. — The radula is strongly developed. Its formula 1 . 1 . 1 agrees with what is found in the Thecosomata, but Boas and Pelseneer have clearly pointed out, that this conformity in the number of teeth is quite accidental. Besides, the form of the teeth (fig. 155) is quite different from that of the Thecosomata. The median tooth has no denticles; each lateral tooth possesses a broad base and a slender point, which is turned upwards. There are sixteen or seventeen transverse series in the radula. — Immediately in front of it, the jaws are situated, each of which consists of two or three rows of horny plates, the free margin of which is saw-shaped (fig. 156). The anterior plates are stronger than the posterior ones. The jaws themselves unite neither dorsally nor ventrally. — Hook-sacs do not exist here. — Salivary glands are the same as in all Gymnosomata and without real efferent duct. — The oesophagus opens into the stomach at its left anterior corner; the structure of this stomach does not offer special discussion. The intestine arises at the ventral side and runs straight on to the anus, which lies beneath the posterior lobe of the foot, and nearly in the median line, though somewhat to the right. Souleyet says that the intestine "décrit quelques inflexions autour de la poche stomacale"; I have never seen this.

Musculature: In the reticulated connective tissue between the skin and the visceral mass, three flattened muscle-bands attach this visceral mass to the body-wall. They are inserted in the region of the neck, while distally they divide into several branches, which are strongly attached to the skin. Two of the muscles are dorso-lateral, one on each side of the body. The third is ventral and median.

Generative organs: the gonad is situated posteriorly, and sometimes a little ventrally, to the stomach. The efferent duct issues quite dorsally, then passes to the left and ventrally (without exhibiting perceptible swellings in its course) and opens in the usual position, beneath the distal margin of the right fin. As the stomach occupies the left portion of the visceral mass, the genital duct is situated at the right side of the stomach; it crosses the rectum at its dorsal side. The accessory genital glands and the receptaculum seminis are situated in the usual position, but I could not observe a separate muciparous and an albuminiparous gland. The accessory genital glands have been already recorded and figured by Souleyet [2]). Speaking

1) Voyage de la Bonite, vol. II, p. 246.
2) Voyage de la Bonite, vol. II, p. 248, pl. XV, fig. 4.

about the digestive tract this author notes [1]), at the right side of the stomach, "un corps dur et jaunâtre", the function of which he could not make out. PELSENEER [2]) declared this hard body to be the muciparous gland. I too have found it in all specimens; in formol-preservation it is opaque, whitish, while it becomes horny, transparent and brown in alcohol. I cannot, however, regard it as a gland. For first it has never any connection with the genital duct (as may be seen in transverse sections); and secondly it does not exhibit the structure of a gland in any way, but is quite homogeneous, without showing cells or nuclei, and diffusedly absorbing colouring matter. Perhaps it is a secretion of some gland which, however, is not yet known itself.

The penis, when invaginated, is club-shaped, and curved dorsally at its distal end. It opens at the base of the right lateral lobe of the foot, as may be seen in transverse sections.

A most curious fact in *Halopsyche* is that this animal is ovoviviparous. This peculiarity has been discovered already by MACDONALD [3]) who found larvae in an advanced stage of development. Nearly all the specimens of the Siboga enclosed larval stages in the connective tissue beneath the skin. As the youngest stages were especially well represented, their study is of the greatest importance. But I have thought it better to delay a full description of them, as I intend to combine this study with other embryological researches on the Gymnosomata at the Naples Station.

Although I took great care, I have not been able to recognize with certainty the heart or the kidney. Not one specimen possessed an organ which could answer to a circulatory or excretory apparatus. This fact is the more to be regretted, as neither SOULEYET nor PELSENEER have been more fortunate. SOULEYET mentions a sac (the heart?) at the base of the so-called "gills" (the buccal appendages), and PELSENEER notes some "very delicate organs" at the right-side of the body.

I have found the central nervous system and the nerves issuing from it quite the same, as PELSENEER described it. The visceral mass consists of three ganglia, while the pleural and cerebral ganglia are fused together. There is only one nerve to the nuchal tentacle. The cerebro-buccal connectives are remarkable for their shortness.

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1) Op. s. c., p. 246, pl. XV, fig. 4, 1, 9.

2) Chall. Rep., LXVI, p. 53.

3) On the anatomy of Eurybia gaudichaudi, Transact. Linn. Soc. Lond., vol. XXII, p. 246, pl. XLIII, fig. 9. Some specimens of the Challenger, which I examined in the British Museum, were also provided with young larvae, a peculiarity which escaped the notice of PELSENEER.

LIST OF THE SPECIES OF THECOSOMATA AND GYMNOSOMATA IN THE AUSTRALASIAN WATERS

Species, marked by an asterisk, have not been found by the Siboga.

A. THECOSOMATA.

I. LIMACINIDAE.

Limacina Cuvier.

Limacina inflata (d'Orbigny).
*Limacina lesueuri (d'Orbigny).
Limacina trochiformis (d'Orbigny).
Limacina bulimoides (d'Orbigny).

Peraclis Forbes.

Peraclis reticulata (d'Orbigny) var. minor n. v.
Peraclis rissoides n. sp.
Peraclis moluccensis n. sp.

II. CAVOLINIIDAE.

Clio Linné.

Subg. *Creseis* Rang.

Clio (Creseis) virgula (Rang).
Clio (Creseis) acicula (Rang).
*[Clio (Creseis) chierchia Boas] [1]).

Subg. *Hyalocylix* Fol.

Clio (Hyalocylix) striata (Rang).

Subg. *Styliola* Lesueur.

Clio (Styliola) subula (Quoy et Gaimard).

Subg. *Clio (s. str.)* Linné.

Clio balantium (Rang).
Clio pyramidata Linné.
Clio cuspidata (Bosc).

Cavolinia Abildgaard.

Subg. *Diacria* Gray.

Cavolinia (Diacria) trispinosa (Lesueur).
Cavolinia (Diacria) quadridentata (Lesueur).

Subg. *Cavolinia (s. str.)* Pelseneer.

Cavolinia tridentata (Forskål).
Cavolinia uncinata (Rang).
Cavolinia gibbosa (Rang).
Cavolinia globulosa (Rang).
Cavolinia longirostris (Lesueur).
Cavolinia inflexa (Lesueur).

Cuvierina Boas.

Cuvierina columnella (Rang).

III. CYMBULIIDAE.

Cymbulia Peron et Lesueur.

Cymbulia sibogae n. sp.

Cymbuliopsis Pelseneer.

*Cymbuliopsis ovata (Quoy et Gaimard).
Cymbuliopsis intermedia n. sp.

1) Reference is made to this species, on account of a statement by BOAS (Spolia atlantica, p. 62) that one specimen was caught at 137° E., 10° N. The occurrence of this species in the Australasian province is therefore scarcely doubtful.

B. GYMNOSOMATA.

I. Pneumonodermatidae.

Pneumonoderma Cuvier.

Pneumonoderma peroni (Lamarck).
*Pneumonoderma mediterraneum (van Beneden).
Pneumonoderma heterocotylum n. sp.
Pneumonoderma pygmaeum n. sp.

II. Clionopsidae.

Clionopsis (Troschel).

*Clionopsis grandis (Boas).
Clionopsis microcephalus n. sp.

III. Notobranchaeidae.

Notobranchaea Pelseneer.

Notobranchaea inopinata Pelseneer.

IV. Clionidae.

Clione Pallas.

Clione punctata n. sp.

Paraclione n. g.

Paraclione pelseneeri n. sp.

V. Halopsychidae.

Halopsyche Bronn.

Halopsyche gaudichaudi (Souleyet).

APPENDIX.

When this work was being printed it appeared necessary to add some remarks:

I. During my stay at the Zoological Station at Naples I had an opportunity to get a look into GIOËNI's work, mentioned on p. 34. The author proposes on p. XXIV and p. XXV that the animal, which without any doubt must be *Cavolinia tridentata*, shall be called after him.

II. In August 1903 appeared a study by PELSENEER on the Mollusca of the Belgian Antarctic Expedition (Résultats du Voyage du S. Y. Belgica, Mollusques par P. PELSENEER "Pteropoda", p. 29—31). On p. 30 we find that the operculum of *Limacina antarctica* is coiled to the left.

III. In the Zool. Anz., Bd. XXVII, N° 10 and 11, MEISENHEIMER describes, after having studied sufficient material, the anatomy of *Desmopterus*. A definite opinion with respect to the systematic place the author does not give; yet he seems inclined to think that *Desmopterus* must be reckoned among the Gymnosomata.

IV. While printing this paper, I became acquainted with the very recently published study by KWIETNEWSKI, "Contribuzione alla conoscenza anatomo-zoologica degli pteropodi gimnosomi del mare mediterraneo, Roma, 1903". Besides an extensive systematic and anatomical treatment of the whole group, important information is given with respect to the Gymnosomata, observed by the writer in the Strait of Messina. Some larval stages especially are of importance and among these must be mentioned Thliptodon, which had not been found again since GEGENBAUR (1855). The author identifies Thliptodon with Pteroceanis Meisenheimer. To my infinite regret I have not been able to take into account the results of the paper above-mentioned, as my researches had come to an end already before.

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1887. —— Recherches sur le système nerveux des Ptéropodes, Arch. Biol., vol. VII.

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1890. PECK, J. J. On the anatomy and histology of *Cymbuliopsis calceola*, Stud. Biol. Lab. J. Hopk. Un., vol. IV, p. 334—353.

1) BOAS has given in his Spolia atlantica (p. 174—176) a complete list of the principal works treating on "Pteropoda", up to the year 1885.

1890. Smith, Edg. A. Report on the Marine Molluscan Fauna of the Islands of St.-Helena, Proc. Zool. Soc. Lond., 1890. ("Pteropoda": p. 254).

1891. Pelseneer, P. Sur la dextrorsité de certains Gastropodes dits "sénestres", Comptes rendus, t. CXII, p. 1015—1017.

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EXPLANATION OF PLATES

PLATE I.

Fig. 1. Operculum *Limacina inflata* d'Orb., from the outside.
Fig. 2. Stomach *Limacina helicina* Phipps, ventral view. *a*, oesophagus; *b*, beginning of the intestine; *c*, coecum.
Fig. 3. Central nervous system *Limacina helicina* Phipps, *A*, ventral view. *B*, from the left side. *C*, from the right side.
p and *p'*, left and right pedal ganglion; *v* and *v'*, left and right visceral ganglion; *c* and *c'*, left and right cerebral ganglion; 1 and 1', nerves to the fins; 2, left pallial nerve; 3, right pallial nerve; 4 and 5, visceral nerves; 6—9, nerves to the tentacles and to the lips; 10, cerebral commissure; *ot* and *ot'*, left and right otocyst.
Fig. 4. Shell *Peraclis reticulata* var. *minor*. 36 ×.
Fig. 5. Shell *Peraclis rissoides* n. sp. 33 ×.
Fig. 6. Operculum of the same, from the outside.
Fig. 7. Shell *Peraclis moluccensis* n. sp. 25 ×.
Fig. 8. The same, seen from apex. 20 ×.
Fig. 9. Fragment of the same, seen from apex. 60 ×.
Fig. 10. Operculum of the same, seen from the outside.
Fig. 11. Head *Peraclis rissoides* n. sp. Dorsal view.
Fig. 12. Jaw *Peraclis reticulata* var. *minor*, 2nd ser. of right jaw.
Fig. 13. Pallial gland *Peraclis rissoides* n. sp., from the outside. *a*, "balancer".
Fig. 14. Central nervous system *Peraclis rissoides* n. sp. *A* ventral view. *B*, from the right side. Explanation of letters the same as in fig. 3. Besides, *p. v.*, posterior visceral ganglion.
Fig. 15. Shell "*Agadina*" n. sp. *A*, from aperture. *B*, from umbilicus. 22 ×.
Fig. 16. Shell (probably abnormal) of *Clio (Hyalocylix) striata* (Rang). Ventral view. 10 ×.
Fig. 17. Embryonic shell of *Clio (Hyalocylix) striata* (Rang).
Fig. 18. Intestine *Clio cuspidata. a*, intestine; *b*, glandular organ, attached to it.
Fig. 19. Accessory genital glands *Clio (Creseis) acicula* (Rang), from the left side. *a*, efferent duct of the gonad; *b*, accessory genital gland; *c*, vas deferens ("*Vagina*" Gegenbaur); *d*, receptaculum seminis (?).
Fig. 20. Genital organs *Clio (Styliola) subula* (Quoy et Gaimard). Dorsal view. Explanation of letters the same as in fig. 19. *g*, gonad.

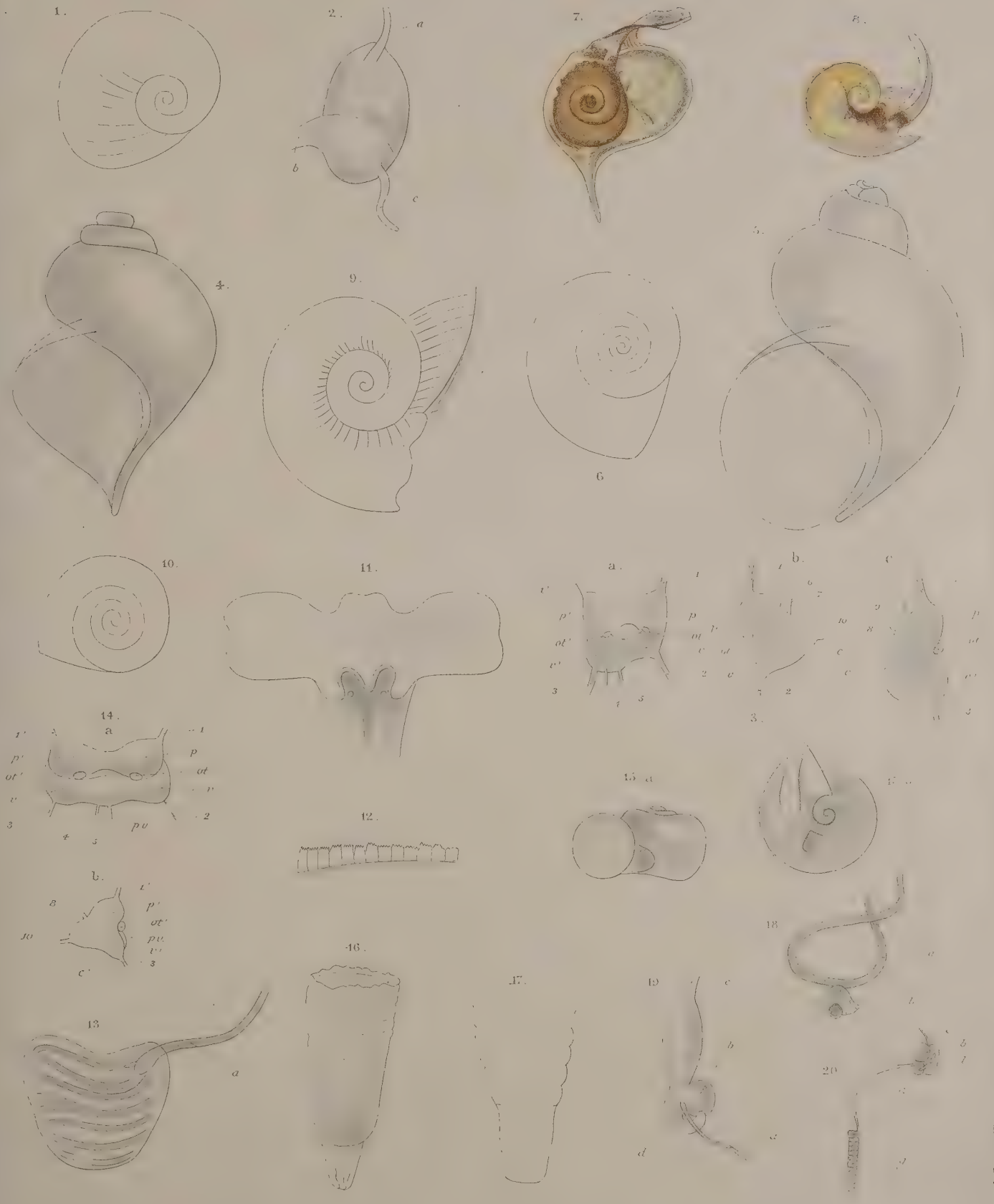

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PLATE II.

Fig. 21. Central nervous system *Clio (Creseis) acicula* (Rang). Ventral view.
p and *p'*, left and right pedal ganglion; *v* and *v'*, left and right visceral ganglion; 1 and 1', nerves to the fins; 2, left pallial nerve; 3, right pallial nerve; 4 and 5, visceral nerves; *ot* and *ot'*, left and right otocyst.

Fig. 22. Central nervous system *Clio pyramidata* (Linn.). Ventral view.
Explanation of letters the same as in fig. 21. Besides, 6, tentacular nerve.

Fig. 23. Buccal ganglia *Clio pyramidata* (Linn.), fused together as in all Cavoliniidae.

Fig. 24. Cervical organ *Cuvierina columnella* (Rang), from the right side.

Fig. 25. Genital organs of the same, dorsal view. *g*, gonad; *a*, its efferent duct; *b*, accessory genital glands; *c*, vas deferens.

Fig. 26. Central nervous system of the same. *A*, ventral view. *B*, from the left side.
p, pedal ganglion; *v*, visceral ganglion; *c*, cerebral ganglion; *a*, anterior pedal commissure. 1 and 2, nerves to the fins; 3, left pallial nerve; 4, right pallial nerve; 5 and 6, visceral nerves; 7, a nerve perhaps supplying the cervical organ; 8 and 9, nerves to the tentacles and to the lips; *ot*, otocyst.

Fig. 27—31. Different shells of *Cavolinia (Diacria) trispinosa* (Les.). 2×.

Fig. 32. „*Hyalaea affinis*", a variety of *Cavolinia tridentata* (Forskål); dorsal view. 2×.

Fig. 33. The same, seen from the left. 2×.

Fig. 34. Probably anomalous shell of *Cavolinia gibbosa* (Rang). 2×.

Fig. 35. The same, seen from the left. 2×.

Fig. 36—44. Series of shells of "*Pleuropus longifilis*" Troschel, to show the transition to the adult *Cavolinia tridentata* (Forsk.). Seen from the right. 2×.

Fig. 45—53. Series of the same specimens, dorsal view. 2×.

Fig. 54—58. Series of shells of *Cavolinia inflexa* (Les.), transition from the variety *lata* to *longa*. Dorsal view. 2×.

Fig. 59—63. Series of the same specimens, seen from the left. 2×. The specimens 1 and 4 in these series were caught by the Siboga, the other specimens are from the Atlantic.

Fig. 64. Shell and animal of "*Cleodora compressa*" Souleyet. Ventral view. 10×.

Fig. 65. Shell of "*Cleodora pygmaea*" Boas.

Fig. 66. Shell of "*Pleuropus longifilis*" Troschel, from Naples. Dorsal view. 10×.

Fig. 67. Same specimen, seen from the right. 10×.

Fig. 68. Shell and animal of "*Pleuropus longifilis*" Troschel. (Siboga-specimen). Dorsal view. 10×.

Fig. 69. Same specimen, seen from the left. 10×.

Fig. 70. Shell of "*Hyalaea rotundata*". Dorsal view. 10×.

Fig. 71. The same specimen, seen from the right. 10×.

Fig. 72. Shell of "*Hyalaea levigata*". Dorsal view. 10×.

Fig. 73. Same specimen, from the right. 10×.

Fig. 74. Shell of "*Hyalaea depressa*". Dorsal view. 10×.

Fig. 75. Same specimen, from the right. Nearly adult; the shell is already very much like that of *Cavolinia inflexa*.

Fig. 76. Shell of "*Hyalaea depressa*". Dorsal view. 10×. A younger stage than the foregoing one.

Fig. 77. Same specimen, from the right. 10×.

Fig. 78. Central nervous system of *Cavolinia tridentata*. Ventral view.
p, pedal ganglion; *v*, visceral ganglion; 1, nerve to the fins; 4, left pallial nerve; 3, right pallial nerve; 2 and 5, visceral nerves; *ot*, otocyst.

Fig. 79. Central nervous system of the same, seen from the left.
Explanation of letters the same as in fig. 78. Besides, *c*, cerebral ganglion; 6, tentacular nerve.

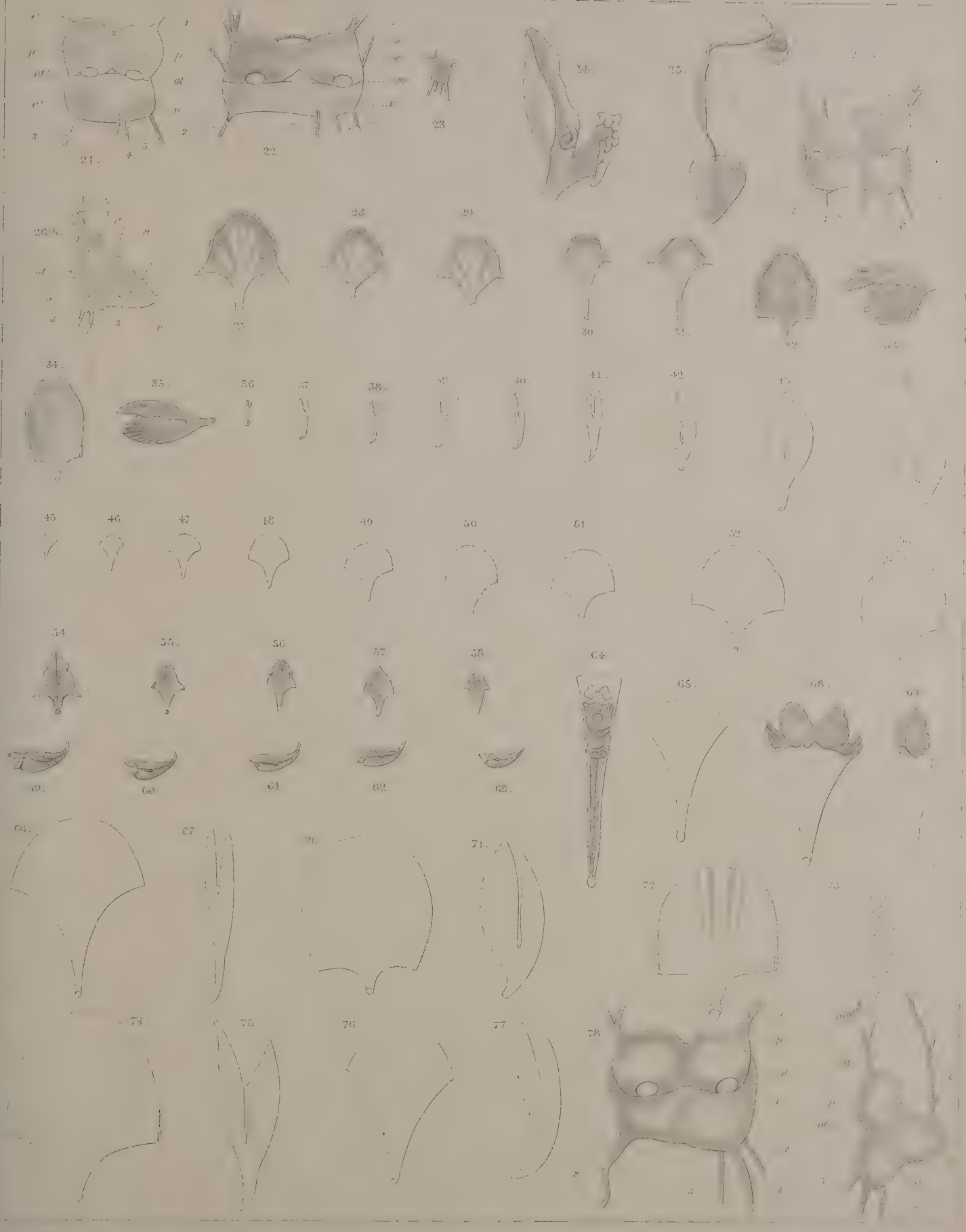

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PLATE III.

Fig. 80. "*Desmopterus*" sp. Aboral view. 10 ×.
Fig. 81. Same specimen. Oral view. 10 ×.
Fig. 82. *Cymbulia peroni* de Blainv. from Naples. Large specimen. Oral view. 2 ×.
Fig. 83. Empty shell of the same specimen, from the right. *a, b, c,* three rows of spines; the first of these rows only reaches the ventral point. Some spines at the aperture are very large. 2 ×.
Fig. 84. Same shell, aboral view. 2 ×.
Fig. 85. Another specimen of *Cymbulia peroni* de Blainv., from the same locality. 2 ×.
Fig. 86. Empty shell of the same specimen, from the right. The row *a* only exists. 2 ×. Spines at the aperture of equal size.
Fig. 87. Same shell, aboral view. 2 ×.
Fig. 88. *Cymbulia sibogae* n. sp. Oral view. 2 ×.
Fig. 89. Same specimen, from the right. 2 ×.
Fig. 90. Same specimen, aboral view. 2 ×. *d, a* row of spines, which (according to PELSENEER's figure at least) does not reach the middle of the shell in *Cymbulia parvidentata.*
Fig. 91—93. Three specimens of *Cymbulia,* without shell. See text. Figs. 91, 93: 2 ×. Fig. 92: 5 ×.
Fig. 94. Pallial gland of *Cymbulia peroni* de Blainv. Aboral view. *d, v,* dorsal, ventral margin. *a, b,* first and second transparent band.
Fig. 95. Dorsal view of the accessory genital glands of *Cymbulia peroni* de Blainv. *a,* efferent duct of the gonad; *b,* muciparous gland; *c,* albuminiparous gland; *d,* receptaculum seminis; *l,* vas deferens.
Fig. 96. Central nervous system of *Cymbulia peroni* de Blainv., ventral view.
a, anterior pedal commissure; *p,* pedal ganglion; *v,* left visceral ganglion; *p. v.,* posterior visceral ganglion; 1, nerves to the fins; 2, left pallial nerve; 3, right pallial nerve; 4 and 5, visceral nerves; *ot,* otocyst.
Fig. 97. The same, from the left. Explanation of letters the same as in the foregoing figure. Besides, *c,* cerebral ganglion; 6, tentacular nerve, 7 and 8, nerves to the proboscis.
Fig. 98. The same, oral view. Explanation of letters the same as in figs. 96 and 97. Besides, 9 and 10, pedal nerves, perhaps supplying the retractor muscle of the proboscis. Nerves to the fins are not figured.
Fig. 99. Distribution of the nerves in the fins of *Cymbulia peroni* de Blainv.

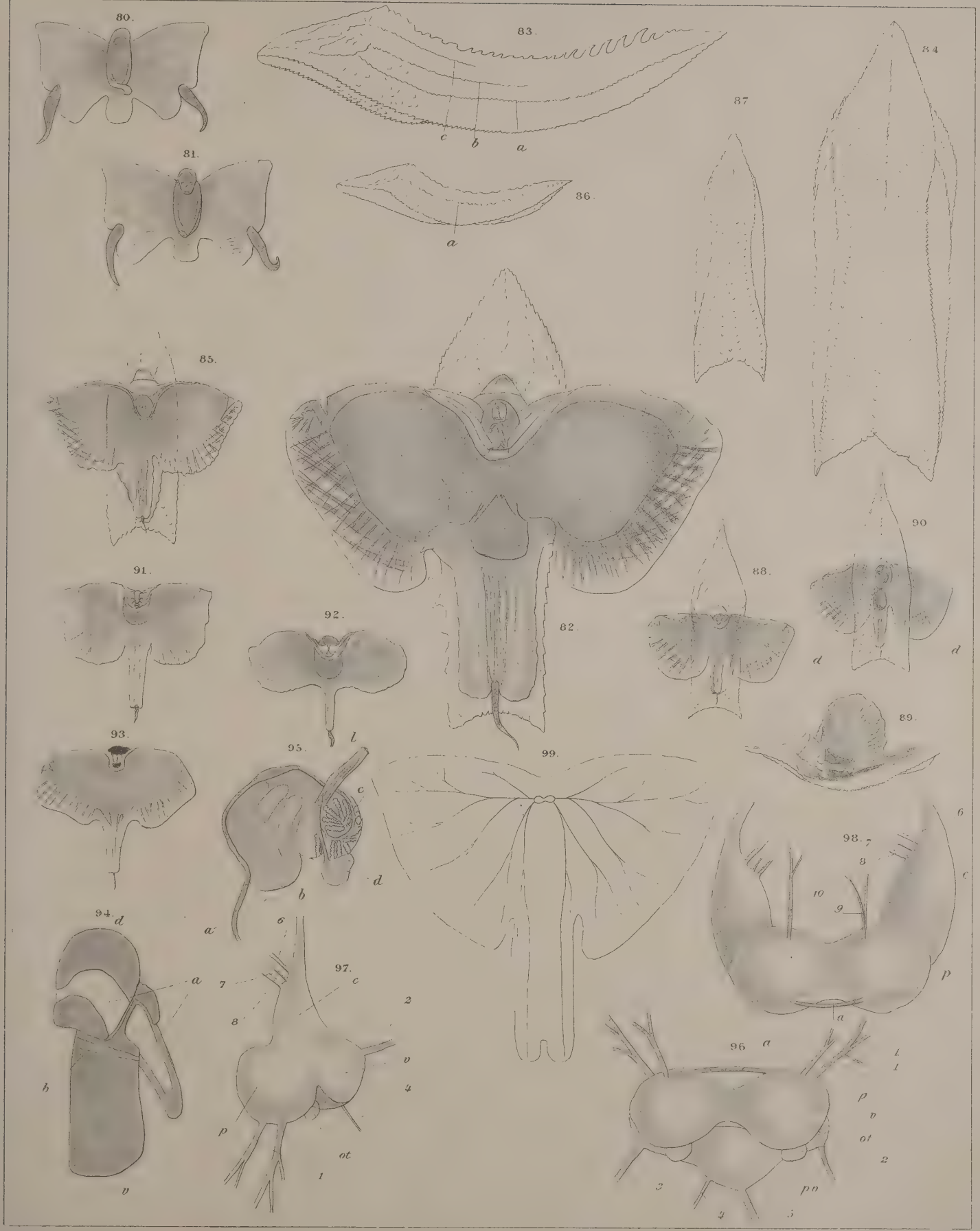

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PLATE IV.

Fig. 100. *Cymbuliopsis intermedia* n. sp., oral view. 2 ×.
Fig. 101. Empty shell of the same species, oral (anterior) view. 2 ×.
Fig. 102. Same shell, (aboral) posterior view. 2 ×.
Fig. 103. Another empty shell, most probably belonging to the same species. Anterior view. 2 ×.
Fig. 104. Same shell, posterior view. 2 ×.
Fig. 105. A specimen of *Cymbuliopsis* without shell, anterior view. 2 ×.
Fig. 106—108. Larval Cymbulidae, perhaps belonging to different species. In fig. 106 the penis is evaginated.
Fig. 109. *Gleba cordata* Forskål from Naples. Anterior view. 2 ×.
Fig. 110. Large shell of the same, posterior view. 2 ×.
Fig. 111. Pallial gland of *Cymbuliopsis intermedia* n. sp., from the outside. *a*, *b*, *c*, three transverse, transparent bands.
Fig. 112. Pallial gland of *Gleba cordata* Forskål, from the outside. *a*, *b*, *c*, have the same meaning as in fig. 111.
Fig. 113. Digestive tract of *Cymbuliopsis intermedia* n. sp. Ventral view. *oe*, oesophagus; *v*, stomach; *i*, intestine; *a*, anus.
Fig. 114. Heart and kidney of *Gleba cordata* Forskål, ventral view.
a, ventricle of the heart; ao_1 and ao_2, two vessels issuing from it; *b*, kidney; *c*, mantle-cavity; *d*, opening of the kidney into the mantle-cavity; *e*, opening of the mantle to the exterior; *pc.*, pericard.
Fig. 115. Central nervous system of *Cymbuliopsis intermedia* n. sp., from the right side.
a, cerebral commissure; *c*, cerebral ganglion; *p*, pedal ganglion; *v*, right visceral ganglion; *pv.*, posterior visceral ganglion; 1, nerve to the tentacle; 2, nerve to the penis; 3, nerve to the proboscis, innervating its retractor muscle; 4 and 5, nerves to the fins; 6, pallial nerve; 7, visceral nerve; *ot*, otocyst.
Fig. 116. Central nervous system of *Gleba cordata* Forskål, from the right. Explanation of letters the same as in fig. 115,
Fig. 117. Distribution of the nerves in the fins of *Gleba cordata* Forskål.

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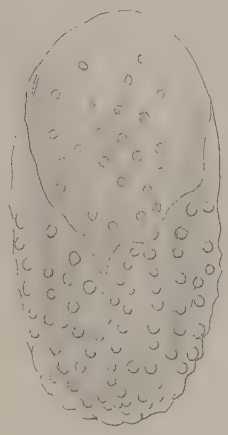
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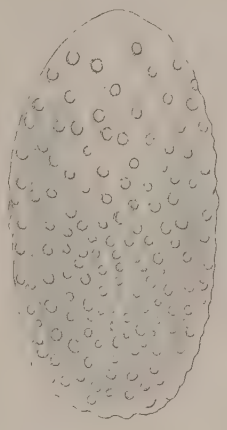
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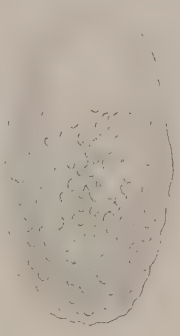
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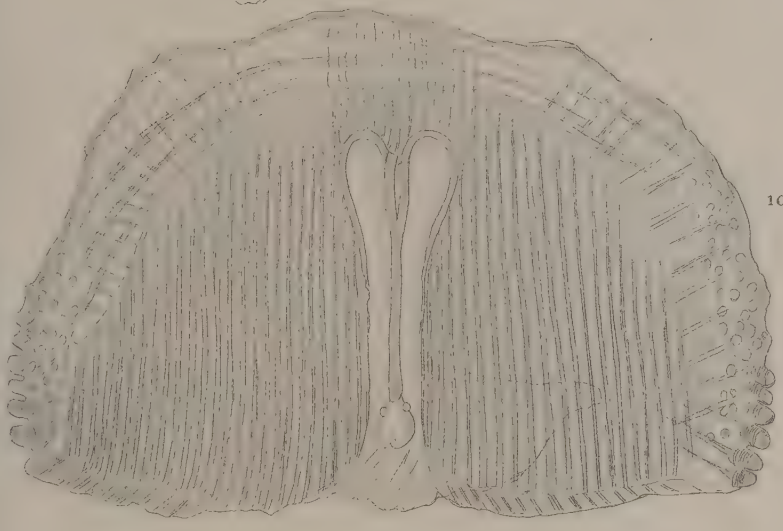
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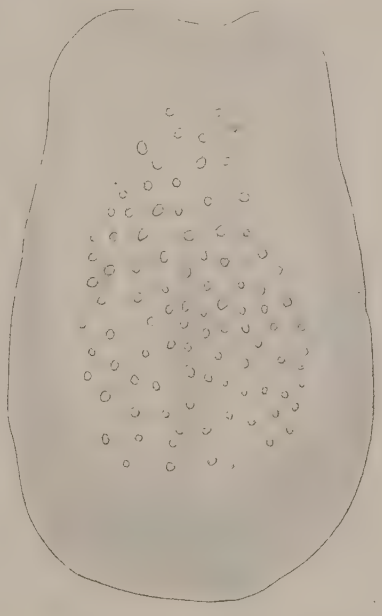
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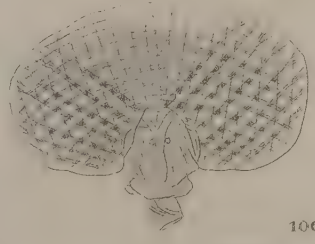

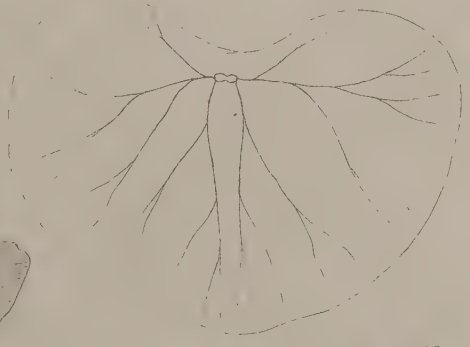

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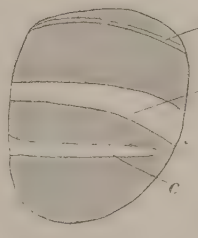

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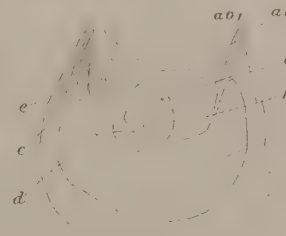

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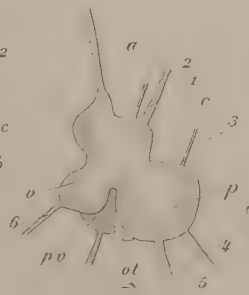

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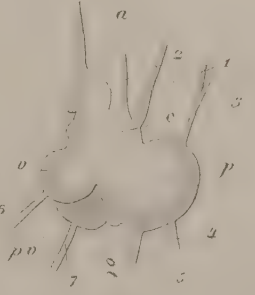

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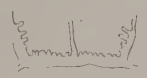
PLATE V.

Fig. 118. *Pneumonoderma heterocotylum* n. sp. Ventral view. 6×.
Fig. 118*A*. Lateral gill of the same.
Fig. 118*B*. Posterior gill of the same, dorsal view.
Fig. 119. Acetabuliferous appendage of the same; out-stretched, from the inside.
Fig. 120. *Pneumonoderma pygmaeum* n. sp. Ventral view. 10×.
Fig. 121. Posterior gill of the same, aboral view. *d*, dorsal; *v*, ventral.
Fig. 122. Acetabuliferous appendage of the same; out-stretched, from the inside.
Fig. 123. Some larval *Pneumonoderma*, ventral view. 10×. Strongly contracted.
Fig. 124. Central nervous system of *Pneumonoderma mediterraneum* (van Ben.). Dorsal view. — Pedal nerves and cerebro-buccal connectives not figured.
c, cerebral ganglion; *a*, cerebro-pedal connective; *b*, cerebro-pleural connective; *p*, pedal ganglion; *pl*, pleural ganglion; *plv*, pleuro-visceral connective; *v*, visceral ganglion.
1, optic nerve; 2, olfactory nerve; 3, auditory nerve, turned to the front; 4, nerve to the labial tentacle; 5—7, nerves to the proboscis, the lips and the buccal appendages; 13, 14, pleural nerves to the cervical region; 15—17, nerves to the envelop of the visceral mass; 18—19, nerves to the viscera.
Fig. 125. Pedal ganglia of the same. Dorsal view.
ap, anterior pedal commissure; *p*, pedal ganglion; *a*, cerebro-pedal connective, *ot*, otocyst.
8, nerve to the foot; 11—12, anastomosing nerves to the fins; 9—10, anastomosing nerves, the function of which remained unknown to me.
Fig. 126. *Clionopsis microcephalus* n. sp. Ventral view. 4×.
Fig. 127. The same, from the left. 4×.
Fig. 128. Radula of the same.
Fig. 129. *Notobranchaea inopinata* Pels. Ventral view. 10×.
Fig. 130. The same specimen. Dorsal view. 10×.
Fig. 131. Head of the same, dorsal view. *bc*, buccal cones.
Fig. 132. Oral aspect of the head; cephalic hood nearly closed. *lt*, labial tentacle.
Fig. 133. Foot of the same; *t*, tubercle.
Fig. 134. Dorsal crest of the gill of the same.
Fig. 135. Radula of the same.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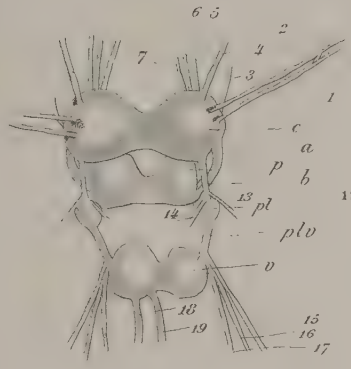

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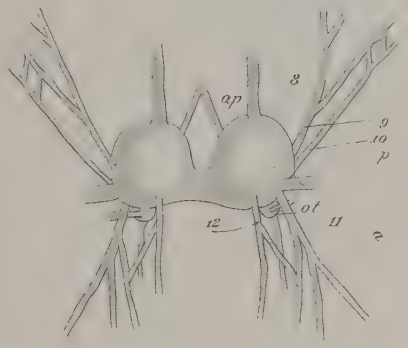

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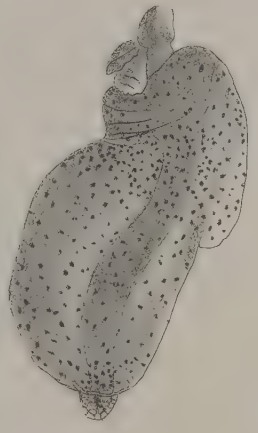
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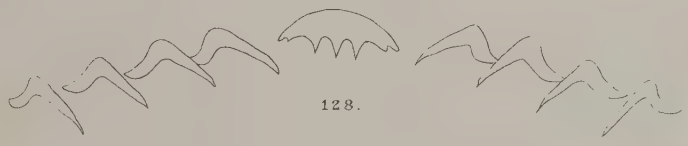
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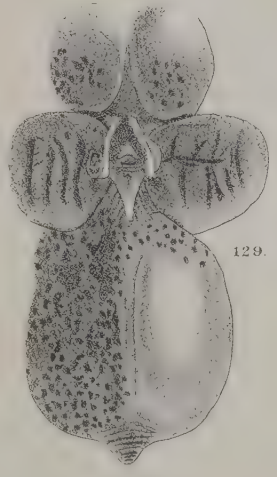
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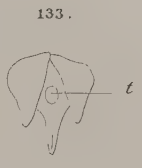

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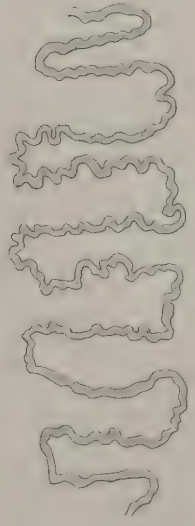
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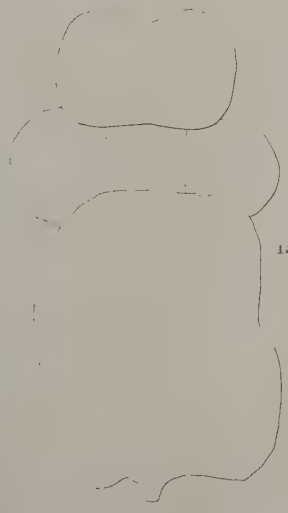
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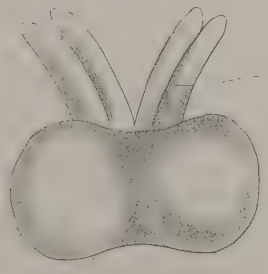

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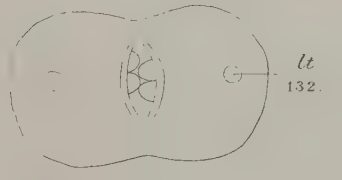

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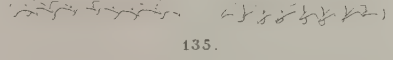
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PLATE VI.

Fig. 136. *Notobranchaea sp.* Larva. Ventral view. 30 ×.
Fig. 137. The same, dorsal view. 30 ×.
Fig. 138. Dorsal view of the aboral extremity of the same, showing the cutaneous glands, and the two ciliated rings.
Fig. 139. Transverse section through one of the "Mundblasen" of *Notobranchaea inopinata* Pels.
a, a layer of epithelial cells with flat nuclei, at the periphery; *b*, layer of glandular cells, immediately beneath *a*, with prolongations into *c*, a reticulated net-work of connective tissue
Fig. 140. Genital organs of *Notobranchaea inopinata* Pels. Ventral view. *g*, gonad; *d*, its duct; *a*, muciparous, *b*, albuminiparous gland; *v*, vas deferens.
Fig. 141. Penis of the same, invaginated. See text.
Fig. 142. *Clione punctata* n. sp., ventral view. 15 ×.
Fig. 143. Chromatophors of the same.
Fig. 144. Central nervous system of *Clione limacina* Phipps. Dorsal view. *c*, cerebral ganglion; *bc*, cerebro-buccal connective; *pc*, cerebro-pedal connective; *plc*, cerebro-pleural connective; *plv*, pleuro-visceral connective; *p*, pedal ganglion; *pl*, pleural ganglion; *v*, visceral ganglion; 1, olfactory nerve; 2, optic nerve; 3, auditory nerve; 4, nerve to the ventral buccal cone; 5, nerve to the labial tentacle; 6, nerve to the dorsal, 7, to the middle cone; 11, pedal nerve, forming a plexus with 12, pleural nerve, to the cervical region; 14, 15, 16, nerves from the visceral ganglia.
Fig. 145. Basal part of the optic nerve, with the two elongated swellings.
Fig. 146. Pedal ganglia of the same. Dorsal view. For the completion of fig. 144. *pc*, cerebro-pedal connective; *apdc*, anterior pedal commissure; *pedc*, posterior pedal commissure; 8 and 10, nerves to the lobes of the foot; 9, nerves to the fins; 13, nerve from the ventral surface of the pedal ganglion.
Fig. 147. *Paraclione pelseneeri* n. sp. Ventral view. 20 ×.
Fig. 148. Another specimen of the same species. Same view. 30 ×.
Fig. 149. A third specimen. Same view. 15 ×.
Fig. 150. A fourth specimen. Same view. 20 ×.
Fig. 151 *A*. Radula of *Paraclione pelseneeri* n. sp.
Fig. 151 *B*. Hooks of the same.
Fig. 152. Oral aspect of the head of the same.
d, dorsal; *v*, ventral; *b*, buccal cone; *l*, labial tentacle; *c*, cephalic hood; *f*, false lips; *r*, radula.
Fig. 153. Head and buccal appendages of *Halopsyche gaudichaudi* (Souleyet). Ventral view.
ba, buccal appendage; *lt*, labial tentacle; *al*, anterior lobes of the foot; *o*, mouth; *nt*, nuchal tentacle; *f*, fin; *pl*, posterior lobe of the foot.
Fig. 154. Transverse section through the skin of the same. *a*, skin, properly so called, *b*, reticulated tissue, between the skin and the visceral nucleus; 1, pavement epithelium; 2, 3, 4, several forms of dermal glands. See text.
Fig. 155. Radula of the same.
Fig. 156 *A, B, C*. Horny plates of the jaws of the same.

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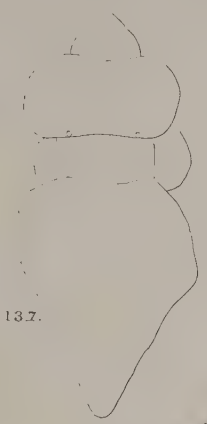
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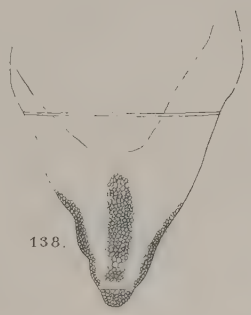
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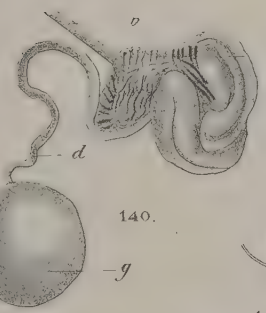

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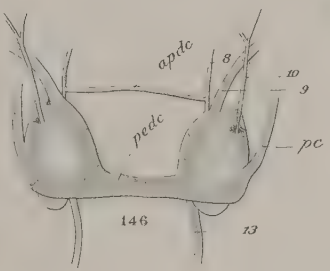

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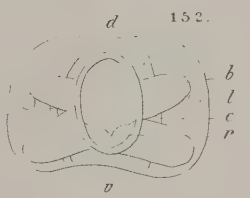

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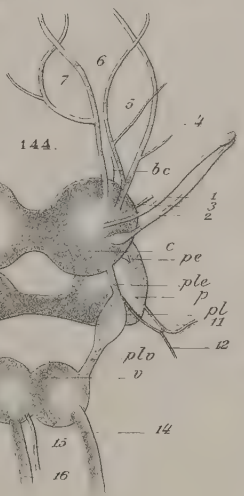

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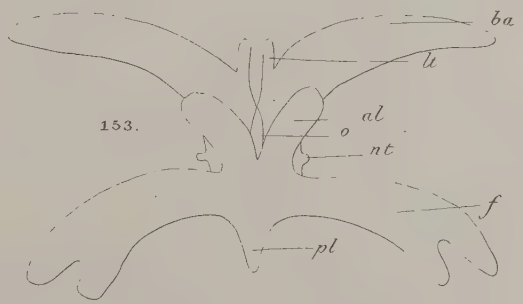

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A.

B.

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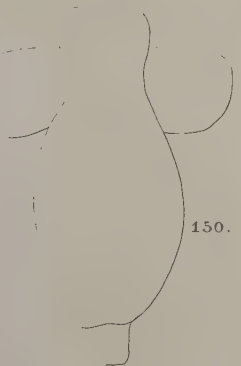
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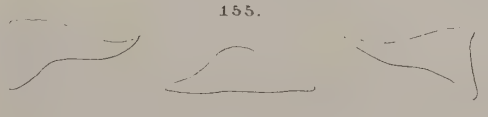
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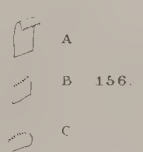

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